CHAPTER XVI

The Materials Battle

Addressing a group of industrialists in March 1942, one of Reybold's top officers declared: "We must win the Battle of Materials just as surely as General MacArthur must win the Battle of the South Pacific. Ours here at home will also be a tough battle."[1] To those responsible for construction, materials presented the greatest single challenge of the war. Throughout 1941 markets had grown progressively tighter. After the outbreak of hostilities, the demand for steel, copper, rubber, and other construction staples far outstripped supply. Sinkings by enemy submarines curtailed imports of certain commodities, such as Turkish chrome, while enemy occupation cut off access to other materials, for example, Manila hemp. Wartime strains on transportation produced local scarcities—asphalt along the Atlantic seaboard and cement in the Great Plains. Shortages of skilled workers and machine tools limited the output of many products, including construction equipment. The situation worsened steadily, as scarcities developed in materials used as substitutes and in substitutes for substitutes. It required a major effort, considerable ingenuity, and dogged determination to cope with the problems of supply.

Reduce to bare essentials. Substitute. Improvise. Comb the country for materials. Get the job done with the means at hand. These were orders of the wartime day. To most civilian construction men—to contractors, architects, and engineers who normally observed rigid building codes, who designed for price, quality, safety, and convenience, and who rarely, if ever, had to do without—these words had an unfamiliar ring. Military engineers knew the language well. In the words of Col. Raymond F. Fowler, chief of the Supply Division, OCE, "The very basis of military engineering is the ability to make out with the means available." He went on to explain:

> When the military engineer up near the front has a bridge to build, he does not expect to find on the site a complete bill of materials. He does not expect to produce a structure with the fine lines and other characteristics of a peacetime job. He does expect to get the bridge built—and to get it built on time.[2]

In the homefront crisis, as on so many battlefronts, techniques of combat engineering served to good advantage.

Bare Essentials

Underscoring the gravity of the materials crisis in the initial months of the war were reports of ominous reverses

[1] Address by Col Raymond F. Fowler, Chief, Supply Div, OCE, before Producers' Council Club of Washington, D.C., 27 Mar 42. EHD Files.

[2] *Ibid.*

and plans for early offensives. The crippling of the Pacific fleet (8 battleships, 3 light cruisers, 3 destroyers, and 4 other naval vessels were sunk or severely damaged at Pearl Harbor); heavy losses of merchant shipping (sinkings by enemy submarines outran new launchings); and Japanese occupation of Manila, invasion of the Dutch East Indies, and capture of Singapore (countries rich in vital raw materials were falling into enemy hands)—these setbacks focused concern on steel production and stockpiles of strategic materials. Churchill's statement, "All our future plans depended on a vast flow of American supplies of all kinds";[3] the mutual assistance pledge by United Nations members, whereby each agreed "to employ its full resources, military or economic," against the Axis powers;[4] and Allied determination to contain the Japanese and strike against the Germans in 1942—all served to emphasize the scale and urgency of the United States logistical commitment. Only by most careful husbandry of essential materials could this commitment possibly be met.

In the weeks that followed the outbreak of war, General Robins considered ways to cut requirements for scarce commodities. A flood of suggestions claimed his attention. Somervell put forward a plan for depots and piers of timber and frame construction. Madigan conceived the idea of taking over resort hotels. Patterson recommended converting abandoned mills and factories into war plants. Colonel Leavey advocated a radical change in igloo design. Colonel Stratton stressed the advantages of switching from mobilization-type to theater-of-operations type housing. He also canvassed the possibilities of wood trusses and considered making greater use of masonry. Various other schemes for substitutions, simplified designs, and fuller use of existing facilities came under discussion. Even double bunking in barracks, a measure Surgeons General had consistently opposed, received some thought. Immense efforts were necessary to translate proposals into actions: conducting tests, running checks, redrawing plans, and winning approvals.[5]

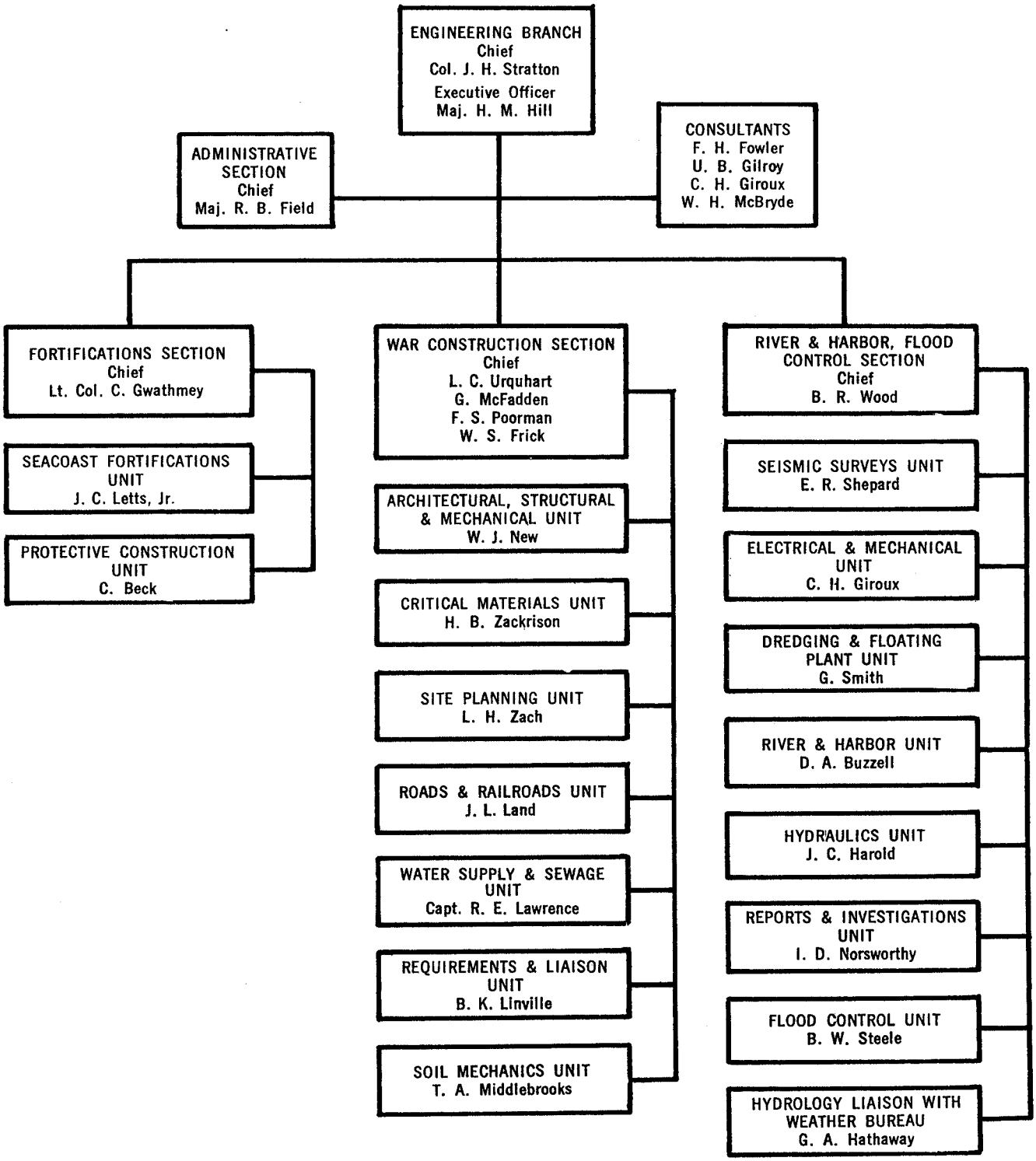
Spearheading the drive to conserve building materials was the Engineering Branch. (*Chart 19*) Combining the heavy construction knowledge of the Corps of Engineers and the building construction experience of the Quartermaster Corps, the organization possessed the skill and versatility the situation demanded. The chief, Colonel Stratton, was, as one of his civilian assistants put it, "an Engineer who was an engineer." In the campaign to save materials, he was able to provide vigorous leadership and sound technical guidance. His executive officer, Maj. Hibbert M. Hill, had a broad engineering background: service with the U. S. Coast and Geodetic Survey, the Engineer Department, and the Northern States Power Company, and four years as instructor at the University of Minnesota. "Unassuming," an associate described him, "but one of the smartest men

[3] Winston S. Churchill, *The Second World War*, vol. III, *The Grand Alliance* (Boston: Houghton Mifflin Company, 1951), p. 641.

[4] *Public Papers and Addresses of Franklin D. Roosevelt*, XI, 3–5.

[5] (1) Memo, Somervell for Reybold, 23 Dec 41. G–4/33890. (2) Memo, Patterson for Reybold, 15 Jan 42. Ord 675/28172–Misc. (3) Memo, Leavey for Wesson, 10 Dec 41. 633 I. (4) Memo, Stratton for Fortifications Sec, Engrg Br, 31 Dec 41. McFadden Reading File. (5) 400.8 Part 1.

Chart 19—Organization of Engineering Branch, Construction Division, OCE
Spring 1942



Source: Orgn Chart, Engrg Br, Constr Div, OCE, 6 Jun 42. EHD Files.

I've ever known."[6] While Urquhart and the other section chiefs made signal contributions, the heaviest burden fell on Harry B. Zackrison, whose job it was to co-ordinate all conservation activities within the construction program. His duties included liaison with WPB and ANMB. He also assisted the section heads in revising specifications and preparing instructions for the field and cleared all policy statements that touched on critical materials. In effect, he functioned as the Corps' materials czar. Missionary spirit and unflagging zeal characterized his efforts. The killing pace he maintained—a 12- to 18-hour day, 7 days a week—sent the trim six-footer's weight plunging from 165 to 109.[7]

Steel—above all, plate steel for ships—was of first importance. On 11 January Zackrison took off with a Presidential air priority to deliver a confidential message to division engineers. The frightful losses inflicted on the fleet at Pearl Harbor were still top secret and would remain so until the end of the war. Enemy submarines were taking a terrible toll in the Atlantic. Face to face with division engineers, Zackrison laid it on the line: steel was a question of national survival; utmost economy in using it was an absolute necessity. His reception in some quarters was cool at first; several senior officers failed to hide their pique at having a young civilian instruct them in their duties. But his earnest pleas at length brought them around. It was a grueling trip: 11 divisions in 7 days,

GENERAL STRATTON. (*Photograph taken in 1944.*)

wretched accommodations, a lost suitcase, and an uncomfortably close call (only a last-minute change in plans prevented Zackrison from taking the plane that carried actress Carole Lombard to her death). Nevertheless, the same day he returned, the first of a series of orders aimed at conserving steel—it specified wood trusses for all but the largest warehouses and hangars—went to the field. On the depot storage program alone, the anticipated saving was 200,000 tons of steel, enough to build 7,500 medium tanks.[8]

Though steel was the sternest challenge, it was by no means the only one. Rubber, tin, aluminum, nickel, chromium, copper, zinc, lead, iron, and hemp—all were commonly used in construction and all were critical. To ease

[6] Zackrison Interv, 19 Feb 65.

[7] (1) Memo, Stratton for All Sec's, Engrg Br, 3 Feb 42. McFadden Reading File. (2) *Cast Iron Pipe News*, December 1960–January 1961, p. 15. (3) WD Commendation of Exceptional Civilian Service: Harry B. Zackrison. (4) Zackrison Interv, 19 Feb 65.

[8] (1) Zackrison Interv, 19 Feb 65. (2) OCE Circ Ltr 1092, 19 Jan 42. (3) *ENR*, April 2, 1942, p. 6.

HARRY B. ZACKRISON

the strain on supplies, General Robins decreed "the least possible use of these materials." His orders were, if a suitable alternate can be found, use it. Cost and durability would be secondary considerations.[9] Finding suitable alternates was no simple task. To be sure, some moves were obvious, such as using porcelain door knobs instead of brass. But often the trick was in substituting a scarce material for one even more scarce: copper for aluminum, steel for copper, iron for steel, and so on. There was no magic formula, Zackrison observed; rather the secret lay in "keeping everlastingly at the matter in small details as well as large"—in combing the specifications, cudgeling one's brains for fresh ideas, inducing manufacturers to change their products, and persuading users to sacrifice comfort, convenience, and efficiency.[10] Difficulties notwithstanding, hosts of ideas proved practicable: plastic screens instead of copper, asphalt or fiber filler instead of rubber in expansion joints, and cotton braid impregnated with paraffin instead of jute for caulking sewage and water pipes—to mention a few. Because the program was so vast, small changes promised big results; for example, a switch from cast iron to vitreous china grease traps promised to save well over 800 tons of much needed metal. Gaging early progress was a circular issued in February 1942, a 45-page document which listed more than 300 substitutes.[11] And further sweeping conservation measures were in the works.

By late January 1942, Colonel Stratton was ready to implement a major change in construction policy, adoption of TO-type drawings for use in the United States. At the time of Pearl Harbor, plans for shelter in overseas theaters were on file in OCE. Developed with funds furnished by the New York City WPA during Somervell's term as administrator and designed primarily to reduce cargo tonnage, these structures were little more than shells without floors or utilities. To use the plans as they were would have serious repercussions. Earthen floors and pit latrines clearly would not do for stateside soldiers, who, as General Reybold was fond of saying, had to be met at the railroad station with coffee and doughnuts.[12] Convinced, nevertheless, that TO standards and criteria were the answer to troop housing problems, Stratton decided to modify the plans.

[9] OCE Circ Ltr 1245, 21 Feb 42.

[10] Address by H. B. Zackrison before Meeting of ASCE, Niagara Falls, NY, 14 Oct 42. EHD Files.

[11] OCE Circ Ltr 1245.

[12] (1) 600.12A Parts 1–3. (2) 600.12 Part 6. (3) Reybold Interv, 12 Mar 59.

BACHELOR OFFICERS' QUARTERS (*Theater-of-Operations type*), *Sioux Falls Army Air Force Base, South Dakota.*

Describing his procedure, he wrote:

> To effect the rapid completion of the revised Theater of Operations designs, we designated various District Engineers throughout the country to undertake specific parts of the redesign program. These men did a tremendous job both with respect to the quality of work and speed of accomplishment. As each District completed designs of buildings and facilities under its assignment, the designs were reproduced and distributed to all other Districts and Divisions. By this procedure scarcely a step was lost in programming the new type of construction to replace the mobilization type which the war effort could no longer afford.[13]

The revised plans featured wood floors, running water, and potbellied stoves. Latrines were in separate buildings. Before the end of January complete sets of the blueprints were in district and division hands. On 6 February Somervell adopted the TO drawings for all new camps and stations, most of which would be in use for only a year or two.[14]

The new structures were a far cry from the comfortable mobilization types. Drab, light-frame buildings (the 32-man barracks was a simple one-story affair), the TO's carried an exterior finish of 15-pound felt with wood lathing on wall sheathing. In appearance they were not unlike tar paper shacks. "A sorry thing," one officer called them, with "a safety factor of one."[15] But however much they suffered by comparison with the 700 and 800 series, their adoption resulted in tremendous savings: 39 percent on iron, 42 percent on lumber, 47 percent on steel, 56 percent on lead, 59 percent on copper, 61 percent on cement, and 66 percent on tin. During the war, TO-

[13] Ltr, Stratton to OCMH, 1 Mar 55. EHD Files.

[14] (1) OCE Circ Ltrs 1156 and 1141, 30 Jan 42 and 4 Feb 42. (2) WD Ltr AG 600.12 (2-5-42) MO-D-M, 6 Feb 42. QM 600.1 1942-43.

[15] Dreyer Interv, 27 Feb 59.

type shelter accommodated roughly 1.5 million men.[16]

Questions of hospital design took longer to resolve. Shortly after the United States entered the war, Somervell, as G–4, revoked authority to use the plans for two-story semipermanent, fire-resistant hospitals—plans developed during his term as Chief of the Construction Division. Feeling that masonry work would move too slowly, he issued an order on 29 December, directing the Engineers to employ mobilization drawings for one-story wooden hospitals.[17] Two days later, at the insistence of The Surgeon General,[18] he modified these instructions to permit the Engineers to accept alternate bids and build fire-resistant hospitals "whenever loss of time or material increase in cost is not involved."[19] There would be more see-sawing back and forth before the issue was finally settled.

Groves was dismayed by Somervell's decision. "Terrible," he complained. "An alternate always gets you into trouble." If masonry got the nod, the old argument "wood is cheaper" would arise immediately. If the decision went the other way, the Engineers would "have to go over to The Surgeon General and argue out on price with him." Although willing to "bend over backwards" to satisfy the medics, Groves disliked being hamstrung by hard and fast rules. "Where time of construction with tile or block would be unduly long, we can go to wood construction, and where feasible, we can use asbestos shingles," he told Strong in G–4. "Leave it right up to us as to what to do, I think, would be the wise thing." Reasoning aloud, he continued:

> Of course, the real solution should be, in my opinion, to do part of the hospital in tile and part of it in wood. Cut the tile work down to a minimum where you find that you can; for example, take the surgery and the clinics and the administration building—put those in tile and you've gone a long way toward keeping the heart of your hospital reasonably safe from fire. That is what I'd like to see done. Now, the barracks and the storehouses I'd like to see left in wood. I do not object to wooden wards, but I'd just as soon have, say, one or two wards in tile right alongside the surgery where you could put your really bad cases and not have to worry about evacuating them so fast.

Feeling he was on the right track, Groves decided to follow through.[20]

On 14 January 1942, after reaching an understanding with Surgeon General Magee, Robins made a proposal to G–4. He had three recommendations: first, that general hospitals, which would be in use for some time after the war, be of semipermanent design; second, that, except at TO cantonments, station hospitals also be semipermanent, unless the Engineers, after surveying local materials and labor markets, decided otherwise; and, third, that hospitals at TO cantonments be mobilization type. Justifying the proposal for widespread use of tile and block, Robins stated:

> The semipermanent type of hospital should in the normal case cost approximately 17

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[16] (1) Min, Engr Production Conf, 28 Sep 42, pp. 9–10. 337 (Engrs, Corps of). (2) Data compiled from *WD Quarterly Inventory: Owned, Sponsored and Leased Facilities*, 30 Sep 45.

[17] WD Ltr AG 632 (12–27–41) MO–D to the CofEngrs, 29 Dec 41. 632 Part 1.

[18] Memo, Magee for Somervell, 31 Dec 41. 632 Part 1.

[19] D/F, Somervell for Reybold, 31 Dec 41. G–4/31741–1.

[20] Tel Conv, Groves and Strong, 31 Dec 41. Opns Br Files, G–4.

TABLE 16—HOSPITAL COST ESTIMATES

	Cantonment	Combination	Semipermanent
Totals	$3,064,812	$3,791,405	$4,448,901
Buildings	2,300,000	3,231,581	3,967,064
Utilities	690,000	485,000	417,000
Telephone	33,687	28,231	12,775
Equipment	41,125	46,593	52,062

Source: Memo, Daley for Groves, 30 Jan 42. Opns Br Files, Hospitals.

percent more than the cantonment type hospital. Opposed to this increase in cost are greater suitability for the intended purpose, greater ease of maintenance and administration, and greater resistance to fire hazard. These factors are believed to outweigh the increased cost.

Pressing for a prompt decision, he reminded Somervell that deliveries of boilers, hot water tanks, and other critical items of installed equipment would govern hospital completion dates. Because equipment for the two types of hospital differed in size and quantity, the Corps could place no orders until Somervell made a ruling. Somervell approved Robins' suggestions the following day.[21]

Any who thought the issue closed had soon to think again. Estimates for masonry hospitals far exceeded expectations. According to Alfred S. Kurtz, chief of Urquhart's estimating group, the combination hospital proposed by Colonel Groves would cost 24 percent more, and the all-masonry hospital 45 percent more, than the cantonment type.[22] Late in January Kurtz drew up estimates based on a 1,750-bed capacity.[23] (*Table 16*) Early in February Groves told Col. John R. Hall of The Surgeon General's office: "About the semipermanent hospitals—you know we are up the spout on those, . . . and the trouble is they are just going to cost so much more than the wooden ones that the Staff, and particularly General Moore, won't stand for it." He advised Hall, "It is up to you people to get the pressure."[24] The Surgeon General applied pressure, much of it on the Engineers, challenging Kurtz's figures, and, after Somervell approved the TO drawings, trying to prevent the Engineers from using them for barracks and quarters for Medical Corps units at hospitals—but without success. Meanwhile, Robins co-operated with Magee by pushing ahead with plans for five general hospitals of masonry design and five semipermanent station hospitals at advance planned cantonments.[25] An order prohibiting this type of construction seemed bound to come. The question was how soon.

Lowering standards for munitions plants was not a step to be taken lightly. As has been shown, until Pearl Harbor the Army had built Ordnance and

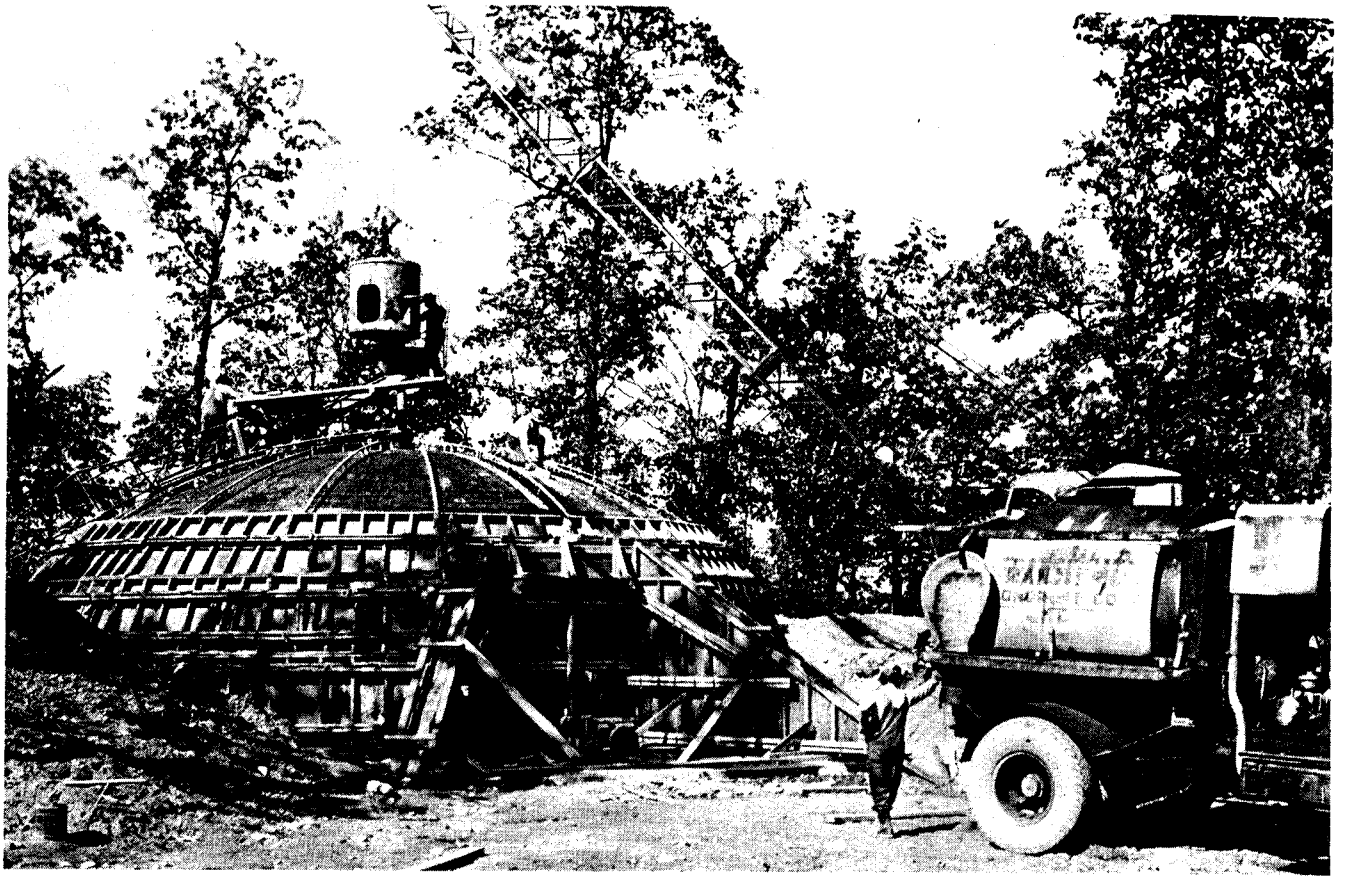
[21] Memo, Robins for Somervell, 14 Jan 42, and approval thereon. G–4/31741–1.

[22] Memo, Stratton for Daley, 30 Jan 42. Opns Br Files, Ground Trps Sec.

[23] Memo, Daley for Groves, 30 Jan 42. Opns Br Files, Hospitals.

[24] Tel Conv, Groves and Hall, 2 Feb 42. Opns Br Files, Hospitals.

[25] (1) Smith, *Hospitalization and Evacuation*, pp. 68–69. (2) 632 II and III.



CORBETTA BEEHIVE MAGAZINE UNDER CONSTRUCTION

Chemical Warfare facilities largely of durable materials and had exercised great care to minimize the dangers of explosion. But once the country was at war, the need for conserving materials prompted consideration of drastic changes in design. Early in 1942 DuPont advised General Campbell that it could develop a plan for stripped-down TNT plants. Although these plants would be more expensive to operate and maintain, DuPont was confident they would be satisfactory in every other way. The West Virginia Ordnance Works, one of the first plants built on the new model, included such features as process buildings with asbestos siding; wooden shops, dormitories, and administration buildings; utilities with five- to ten-year life; concrete water tanks; barbed wire fencing; and duckboard sidewalks. West Virginia took 7 months to build as compared with 21 months for some of the earlier TNT plants. The DuPont typical became the wartime standard for explosives projects and started a trend which accelerated as shortages became more and more acute.[26]

Another early development in the munitions field was an elliptical dome-shaped magazine. Colonel Vandervoort thought up the idea and persuaded the Corbetta Construction Company of New York City to develop plans based on his concept. Shortly before Pearl Harbor,

[26] (1) Memo, Groves for Robins, 2 Jan 42. Madigan Files, Ord–TNT. (2) Compl Rpt, West Virginia OW, 30 Jun 43. (3) Antes Interv, 3 Jun 58.

Corbetta sent completed drawings to Robins, waiving any royalties on the patent. The advantages of the new design were inescapable. While providing equivalent storage at about the same cost, the dome-shaped magazine took half the steel, one-third the copper, and two-thirds the concrete required by the standard cylindrical igloo. At an 800-magazine depot, it would save 3,000 tons of steel, 135,000 pounds of copper, and 50,000 cubic yards of concrete.[27] Used extensively during the war, it was known as the Corbetta beehive. Louis P. Corbetta acknowledged Vandervoort's contribution. "Since most of the savings realized are inherent in the very shape visualized by Lt. Col. Vandervoort," he said, "it is patent that credit for originating the beehive must be chalked up to him rather than to anyone else."[28] The Corbetta brothers also deserved high praise for their generous co-operation with the War Department.

War, someone once said, is a field day for inventors. Proof of this statement was evident at virtually every project, as the drive to conserve critical materials spurred developments holding promise for the future. Plastics were finding innumerable applications. Prefabricated housing was coming into its own. Laminated wood arches were making an appearance. Fireproof wall board, such as masonite, was in great demand. New and cheaper types of wire insulation were becoming standard. Needless refinements were vanishing from toilets and lavatories, and widespread use of vitrified china fixtures was taking them out of the luxury class. Asbestos-cement pipe was replacing metal in water mains, and asphalt-protected metal flashings were replacing copper, zinc, and lead. Peacetime construction had often been unnecessarily costly and many accessories had been overly elaborate. Wartime shortages fostered revolutionary changes in design.[29] Looking ahead to the postwar period, the editor of the *Engineering News-Record* commented in February 1942: "Recent successes attending the use of so-called substitutes for materials that are no longer abundantly available suggest that some of the new designs may turn out to be more than just temporary expedients. . . . They may be new applications that are here to stay."[30]

During the early months of 1942, Zackrison's activities expanded steadily. Along with leading independent engineers and experts of the National Bureau of Standards, he sat on three WPB committees charged with developing emergency codes for steel, reinforced concrete, and timber structures; he headed the first and second of these groups. With Colonel Stratton's help, he created an apparatus to promote savings of critical materials by the Engineer field. Each division engineer appointed a civilian conservation officer for his division and, if the workload warranted, for his districts as well. These men reported directly to Zackrison. More and more of Zackrison's time was taken up by meetings in Patterson's office, by consultations with WPB officials, and after the establishment of SOS, by dis-

[27] (1) F. R. MacLeay, "Concrete Beehive For Munitions Storage," *ENR*, March 26, 1942, pp. 74–76. (2) 633 I.

[28] *ENR*, April 9, 1942, pp. 60–61.

[29] (1) Herbert L. Whittemore, "Materials Shortages —Redesign and Substitutes," *ENR*, January 15, 1942, pp. 114–117. (2) Information Memo, Constr Div for *The Practical Builder*, 31 Aug 42. EHD Files.

[30] *ENR*, February 26, 1942, p. 45.

cussions with Brig. Gen. Lucius D. Clay, Somervell's deputy for requirements and resources, and with members of Clay's staff. Seldom, if ever, did these higher-ups issue an order affecting construction without checking with Zackrison first. In fact, he drafted many of their orders. As his responsibilities increased, he enlarged his staff from one assistant to a dozen, but even then he was hard pressed to do everything the job demanded.[31]

Another approach to conservation—more direct but frequently precarious—was to turn existing facilities to military use. Every factory, hotel, warehouse, hospital, school, and office building pressed into service was obviously that much new construction saved. Under the condemnation statutes and recently enacted requisitioning laws, the Army had ample power to take over properties it required. But in a country with strong antimilitarist traditions, mandatory powers had to be used judiciously. Adhering to long-standing Corps policies, the Engineers relied largely on negotiation, avoiding condemnation wherever possible and rarely commandeering.[32]

In January 1942, Under Secretary Patterson instituted a search for "unoccupied buildings which are capable of being used in their present state or of being readily converted" to use as munitions plants.[33] Ordnance soon turned up a number of possibilities—textile mills, candy factories, and tire and automotive plants. By March the Engineers were negotiating with the owners. Several properties, including the Kelly-Springfield plant at Cumberland, Maryland, were leased for the duration plus three to five years. Several, including those of the U. S. Rubber Company at Eau Claire, Wisconsin, and the New England Southern Company at Lowell, Massachusetts, were purchased. Both methods, purchase and lease, presented difficulties. At Eau Claire and Lowell negotiations broke down and the Engineers had to go to condemnation. At the leased plants, costly improvements were necessary.[34] Excluding machinery, overhead, and fees, Creedon "guessed" that expenditures at Cumberland would run "somewhere in the vicinity of $12 million."[35] The troubles inherent in such arrangements, the problems of eventual settlement and disposal, were obvious, but the immediate advantages were overriding. By late 1942 a half dozen converted plants would be turning out ammunition.[36]

A venture unique in War Department history was launched in February 1942, when the Air Forces decided to establish a technical training center at Miami Beach. The Engineers moved fast. At the height of the tourist season, O'Brien's men arrived to make quick appraisals of

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[31] (1) 400.8 Part 1. (2) Ltr, Zackrison to Shortridge Hardesty, New York, N.Y., 27 Jan 42. 411.5. (3) Zackrison Interv, 19 Feb 65. (4) Telg, Stratton to Div Engrs, 27 Feb 42. Office Files, Specs and Est Br, Engrg Div, OCE. (5) 652 (ORD).

[32] (1) Smith, *The Army and Economic Mobilization*, pp. 221–22, 248. (2) Miller, *Pricing of Military Procurements*, pp. 102–108. (3) OCE Circ Ltr 1015, 1 Jan 42. (4) Gideon, Hist of Mil RE Program, pp. 51–54.

[33] Memo, Patterson for Reybold, 15 Jan 42. Ord 675/28172–Misc.

[34] 601.1 and 635 Allegany, Eau Claire, and Lowell OP's.

[35] Memo, Creedon for Constr Contract Bd, 25 Mar 42. 635 (Allegany OP).

[36] (1) Thomson and Mayo, *The Ordnance Department: Procurement and Supply*, pp. 200–202. (2) Constr PR's.

125 hotels and rush negotiations with the owners. By March, mass leasing was under way at the Florida resort. A wave of jubilation swept through the community, as civic and business leaders pledged 100-percent co-operation.[37] When a handful of hotel men rejected the Army's offers and the Air Forces threatened to move to St. Petersburg, community pressure forced the holdouts into line. On 29 March the Miami *Herald* announced "the good news" that "the running battle of the hotel men against the Army was closed."[38] Soon proprietors signed leases and sent guests packing to make room for the 20,000 airmen who would shortly arrive.[39]

From Miami the Army branched out into other communities. At the luxurious desert resort of Palm Springs, California, the Engineers purchased the El Mirador Hotel and converted it into a general hospital. A sanitarium at Battle Creek, Michigan, and a municipal hospital donated by the city of Temple, Texas, also became Army medical centers. The famous golfing resort at Pinehurst, North Carolina, the exclusive club at Boca Raton, Florida, and the Harrisburg Academy at Harrisburg, Pennsylvania, became air force stations. Racetracks and fairgrounds throughout California served as temporary detention camps for the west coast Japanese. Warehouses belonging to the Southern Compress Company at Savannah, Georgia, served as a supply depot. Properties the country over passed to Army control, as the search fanned out in new directions. Far-reaching though this effort was, it eased the strain but slightly, eliminating tens of new construction projects in a program comprising thousands.[40]

Through the late winter and early spring of 1942, materials shortages worsened steadily. The ANMB list of prohibited items for construction work grew ominously longer. As of 1 April, it included aluminum products of all kinds as well as cadmium, magnesium, manila hemp, mercury, nickel, sisal, and vanadium. Copper and its alloys were available for only 15 specified purposes, lead and rubber for only 6, while iron and steel were obtainable for a mere 58 out of their almost infinite uses.[41] Increasingly, the Engineers were caught in a crossfire between war production authorities, demanding more stringent economies, and contractors, protesting strongly that expensive blueprints and designs were becoming valueless because of constant revision.

Although steel capacity was expanding—in 1942 the United States would produce over 86 million net tons, just 3 million short of the total for all other countries combined—the gap between supply and demand continued to widen. By spring the shortage of plate steel was becoming desperate. Of 15,523 tons the Engineers would require in April, only 5,494 were tentatively scheduled for rolling. Appealing to Clay for help late in March Robins warned that something had to give or serious delays in construc-

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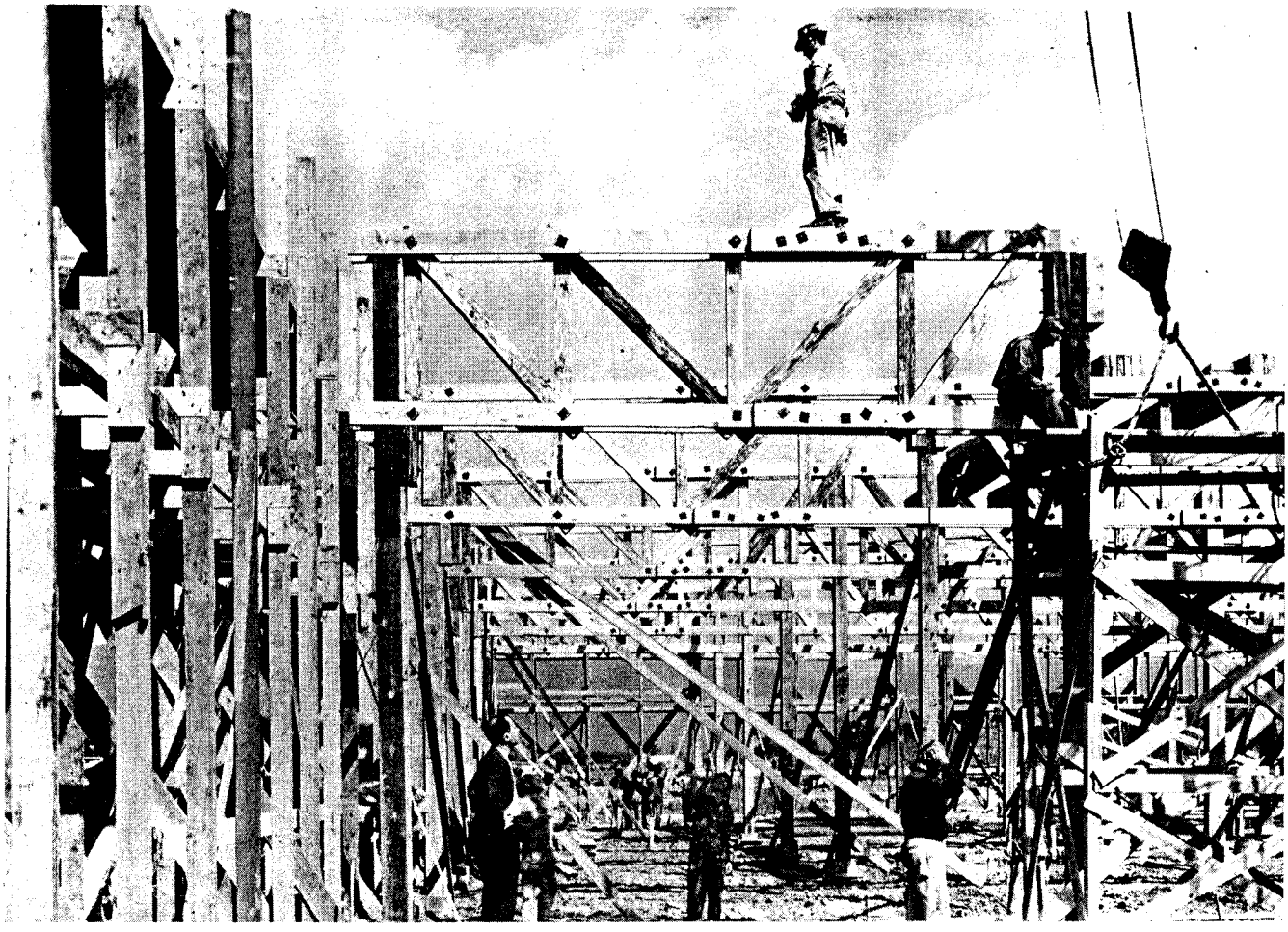
[37] (1) Craven and Cate, *Men and Planes*, pp. 152–53. (2) Truman Comm *Hearings*, Part 21, *passim*.

[38] Reprinted in Truman Comm *Hearings*, Part 21, exhibit 976, p. 9082.

[39] 601.53 (Miami Beach).

[40] Constr and Real Estate PR's.

[41] Ltr, ANMB to Supply Arms and Svcs, 1 Apr 42. Opns Br Files, Equip 1.



WOOD TRUSS CONSTRUCTION, *Pennsylvania Ordnance Works, September 1942.*

tion would occur.[42] General Clay could relieve the Corps' immediate distress, but he held out little hope for the future. On 9 April he assured Groves that the Engineers would get the 15,000 tons they had put in for, and it was even possible that he could squeeze out another 12,000 tons for them. But, he emphasized, "That squeeze is going to be at the expense of an actual weapon."[43] The next day he asked Robins to come up with a plan for further reducing plate requirements—this time to "an absolute minimum."[44]

The Engineers had come a long way already. Reporting to Clay on 18 April, Robins catalogued the substitutions made thus far: wood doors for steel doors; wood framing for steel framing; brick or concrete smokestacks for steel stacks; wood or concrete water tanks for steel tanks; and concrete or asbestos-cement pipe for steel pipe. At hospitals plate steel requirements had dropped 70 percent, and at supply depots, 95 percent. Adoption of the TO drawings had reduced the plate going into cantonments

[42] (1) Truman Comm Rpt 10, Part 3, Feb 43, pp. 1–8. (2) Memo, Robins for Somervell, 26 Mar 42. 411.5. (3) Memo, Robins for Clay, 31 Mar 42. 411.5.

[43] Tel Conv, Clay and Groves, 9 Apr 42. Opns Br Files, Equip 1.

[44] Memo, Clay for Robins, 10 Apr 42. Madigan Files, CofE—Memos, Gen.

nearly 97 percent. At a divisional cantonment the saving on water tanks alone was nearly 400,000 pounds. Even at locks, dams, and power plants economies were numerous. The Corps intended to go still further, reducing the size of hot water tanks to permit use of sheet steel, substituting cast iron for plate steel downspouts, and redesigning hospital heating systems so that cast iron boilers with low pressure steam could take the place of high pressure plate steel boilers. Urquhart was looking into the possibilities of concrete gasoline storage tanks, and Creedon was tackling the difficult problem of stripping more plate from munitions plants.[45]

Pressure to lower requirements for structural steel was also heavy. According to estimates by the Operations Branch, Corps projects would require roughly 245,000 tons of standard and wide flange shapes during the last six months of 1942. The bulk would go into Air, Ordnance, and Chemical Warfare jobs. Some 1,800 tons would be necessary to complete cantonments started under mobilization series plans. Designs at new ground force stations called for no structural steel whatever. Nevertheless, production authorities ordered further cuts. Terming the overall requirement excessive, ANMB chairman Ferdinand Eberstadt insisted on slashing it 25 percent. Only at air projects could the Engineers comply. Colonel Davidson reported that a 10-percent reduction at ports and storage depots was the best he could possibly do.[46] Agreeing to a 10-percent cut at projects under his direction, Creedon made it clear that "further economies in steel cannot be effected except by an abandonment of proposed construction."[47] The Engineers had reached the limit beyond which they could not go and still keep all their jobs moving ahead.

The call for conservation grew ever more insistent. On 16 April Somervell inaugurated a new War Department construction policy: "Because of the requirements of the overall war effort and because of the necessity for saving critical materials and reducing the time of construction, facilities provided will be only those indispensable to the war effort and will be of the simplest type." As if to spell out his meaning, he banned the building of semipermanent hospitals.[48] General Robins hailed Somervell's move as "a definite step forward."[49] What one officer described as "a regular witch hunt for critical materials" proceeded apace.[50] Fresh conservation circulars deluged the field. Sprinkler systems in warehouses were taboo. Air-conditioning was permissible only in hospitals and buildings to house delicate instruments. The design standard for water systems would be 70 gallons per man per day instead of 100. Rainspouts and gutters would be few and far between. Frame sheds at munitions plants would no longer have foundations; walls would rest on concrete slabs, rising and falling with frost motion. Revised specifications called for wood stave pipe, wooden manhole covers, wood or gypsum lath, and wood

[45] Rpt, Robins to Clay, 18 Apr 42. 411.5 I.
[46] 411.5 I.
[47] Memo, Creedon for Sherrill, 20 Jun 42. 411.5 I.
[48] WD Ltr AG 600.12 (4-15-42) MO-D-M, 16 Apr 42.
[49] Ltr, Robins to Div Engrs, 25 Apr 42. 600.1 (MAD).
[50] Address by Lt. Col. R. H. Tatlow before the Bldg Contractors' Assn of New Jersey, Newark, N. J., 16 Oct 42. EHD Files.

or cement-asbestos roof ventilators. The list continued on and on.[51]

Meeting at Kings Mills, Ohio, on 22 April 1942, Ordnance and Engineer officers took a giant step forward. Recognizing the need "to eliminate all critical materials in construction work by using substitute noncritical materials wherever possible and to limit construction to only 'bare necessities,' " they agreed to build temporary small arms ammunition plants. In order to shorten utilities lines, layouts would be more compact. Buildings would be fewer and simple wood framing would be standard. Steam lines would be above ground. Electrical wiring would be "open wire, knob and tube type, or non-metallic cable." Gone would be lightning protection and, except in danger areas, spark-proof floors. The new design entailed serious risks, but General Campbell was willing to accept them.[52]

Site planning provided a fertile field for conservation. Applying the techniques he had used so successfully during 1941, Leon H. Zach effected progressive economies and improvements in layouts for a wide variety of projects: staging areas, holding and reconsignment points, ammunition depots, WAAC training centers, prisoner of war camps, and war housing developments, as well as cantonments, hospitals, and airfields. Zach arranged blocks of buildings more compactly, reduced firebreak distances, cut the size of parade grounds, narrowed roads, shortened utility lines, and decreased overall grading—all of which added up to tremendous savings in materials.[53] Commenting on his colleague's contribution, Zackrison said: "It has been an eye-opener to all concerned . . . how effective planning of this character can be."[54]

By mid-1942, the Engineers had exhausted virtually all the avenues open to them. Stating that further major savings were possible only if The Surgeon General would drop his opposition to double bunking in barracks, Colonel Groves said for the Engineers: "We have done what we can."[55] In July, at the peak of the building program, the War Department publicly announced that cuts in construction had gone as far as they could go.[56]

Procurement Problems

Lucky Strike green had gone to war. To the man in the street, contemplating the unfamiliar wrapper of a popular cigarette, wartime shortages stood for austerity and inconvenience. No new cars or refrigerators; no more silk; ration coupons for tires, gasoline, and sugar; drives to collect scrap metal and salvage abandoned railway and streetcar tracks—Americans accustomed to an economy of plenty were undergoing a novel experience. For construction officers under pressure to meet rigorous deadlines, the unending struggle for supplies, the fight for priorities, the pleas to dealers and materialmen, the ransacking of ware-

[51] (1) Address by Zackrison, 14 Oct 42. (2) Constr Div Circ Ltrs. (3) Rpt, Principal Constr Engr, Detroit Tank Arsenal, 15 Apr 42. 600.13 Part 1. (4) TWX, Groves to Div Engrs, 30 Apr 42. Opns Br Files, Equip 2. (5) Memo, New for Zackrison, 21 May 42. Engrg Div, Spec & Est Br Files, Monthly Rpts. (6) Ltr, Strong to Div Engrs, 11 May 42. 686 (Airfields) Part 55.

[52] Memo, OCE for OCofOrd, 7 May 42. 635 Part 2.

[53] OCE, *Engineering Manual*, 1942, ch. III.

[54] Address by Zackrison, 14 Oct 42.

[55] Min, Engr Production Conf, 22 May 42. 337 (Engrs, Corps of).

[56] WD Press Release, 2 Jul 42. EHD Files.

TABLE 17—BREAKDOWN OF DELAYING FACTORS, 31 MAY–31 OCTOBER 1942

	31 May	30 Jun	31 Jul	31 Aug	30 Sep	31 Oct
Totals	978	1,150	1,121	1,273	1,347	1,050
Materials	648	762	800	932	922	732
Administrative	152	146	91	93	108	54
Weather	79	90	59	70	64	95
Labor	40	46	63	62	121	92
Equipment	32	44	52	55	45	45
Miscellaneous	27	62	56	61	87	32

Source: Summaries of Delaying Factors, prep by Opns Br, Constr Div, OCE, May–Oct 42. 600.914 Part 2.

houses, the periodic lumber buys, and the ceaseless expediting efforts were crucially important. Recalling the critical shortage of construction materials in 1942, "when inventories were exhausted and production controls not well established by the WPB," one former district engineer asserted: "This was the greatest problem facing the field."[57]

Among the delaying factors at construction jobs, shortages of materials were by far the most prevalent. Despite the many efforts to reduce consumption of scarce commodities and the wholesale substitutions and simplifications in design, shortages bulked increasingly large as impediments to progress. Reports from area engineers told a tale of deepening crisis. During the first two weeks in May 1942, the earliest period for which figures were available, difficulties in obtaining materials accounted for 384 delays out of a total of 614. Through the summer, the picture became progressively blacker, as indicated in *Table 17*. In addition to structural, plate, and reinforcing steel, the list of scarce items included motors, pumps, furnaces, pipe, rail, copper wire, hardware, nails, kitchen equipment, and, contrary to early expectations, lumber. Not until the autumn of 1942 did the situation improve.[58]

Fighting the battle of procurement were two organizations, one in Washington, the other in the field. At the time of the transfer in December 1941, the Engineers took over the central purchasing agency created by General Hartman early in the emergency, the Procurement and Expediting Section of the Operations Branch. Renamed the Materials and Equipment Section (M&E), the organization was headed until May 1942 by Maj. Howard H. Reed, a 1931 West Point graduate, who had chosen a career in Quartermaster construction. His successor, Lt. Col. Fred G. Sherrill, commissioned from civil life, was a highly successful businessman. A West Point classmate of Colonel Groves, Sherrill had resigned from the Army in 1926.[59] At local and regional levels, district and division purchasing offices normally handled direct government purchases and co-operated with contractors' purchasing departments. The men in M&E, buoyed

[57] Sturgis Comments, VI, 3 and VIII, 2.

[58] Summaries of Delaying Factors, prep by Opns Br, Constr Div, OCE, May–Oct 42. 600.914 Part 2.

[59] Memo, Robins for Mil Pers Br, OCE, 9 Apr 41. Opns Br Files, Pers.

up by past successes, felt they had the answer to war procurement problems. Among the many who shared this feeling were Patterson and Nelson. Most division and district engineers opposed central purchasing. "A brilliant idea theoretically," Sturgis contended, "but a dismal failure in the field." Maintaining that he knew no district engineer "who didn't think it was a bust," he went on to say: "No organization can fail to make mistakes; but far fewer are made by . . . subordinate field offices, which immediately confront the problem."[60]

After talking matters over with Patterson and Nelson, Robins agreed to adopt the Quartermaster system, and on 29 December 1941 he so informed the districts and divisions. Normally, M&E would purchase lumber in amounts over one million board feet. Under unusual circumstances, Robins would grant requests for authority to buy locally amounts up to 2.5 million board feet. Reed would procure centrally a long list of other items—stoves, heaters, refrigerators, pumps, nails, steel for hangars and control towers, and equipment for bakeries, laundries, and hospitals. In addition, he would co-ordinate allocations, priorities, and rolling schedules for plate steel with the Under Secretary's office. Concessions to the field were soon forthcoming. On 3 January 1942, Robins issued new instructions: there would be no centralized procurement for temporary tent camps or TO-type construction.[61]

Late in December 1941, on the eve of his departure for Great Britain, Colonel Leavey conferred with Robins on purchasing procedures. Developed within the framework of the Quartermaster construction system, Reed's organization had relied on information from the centralized Engineering Branch in deciding what to buy. As plans went forward for decentralizing engineering to the field, Leavey forecast difficulties. Districts and divisions would not ordinarily submit drawings and bills of materials to Washington for approval. How, then, was Reed to discover their requirements? General Robins thought he knew the answer.

> In the interests of simplicity . . . [Leavey explained to Groves], the entire burden of preparing requirements for central procurement should be thrown on the field. It is suggested that this be handled by the issuance to the field of a list showing the types of materials which are to be bought centrally. The District Engineer can use this, first, to announce to contractors in his requests for bids that materials of this type will be furnished by the Government . . . . It can be used, second, to prepare from the bills of materials available in the District office . . . a list to be furnished you centrally for your procurement.

This method, Robins thought, would eliminate delay. When a résumé of the General's ideas reached him, Reed must have shaken his head. Underlining the parts about relying on the field and eliminating delay, he wrote question marks beside them in the margin.[62]

Despite misgivings, Reed followed orders. Through lumber auctions early in January at Richmond, New Orleans, and Seattle, he purchased over 700 million board feet at prices generally below

[60] (1) Ltr, Sturgis to authors, 23 Oct 63. (2) Sturgis Comments, XVII, 1.

[61] OCE Circ Ltrs Constr 222 and 228, 29 Dec 41 and 3 Jan 42.

[62] Memo, Leavey for Groves, 26 Dec 41, and Reed's notations thereon. Opns Br Files, Rental Equip.

OPA ceilings.[63] Calling the transaction "the largest . . . of its kind on record for any single agency, public or private," the War Department announced:

> The lumber acquired would make up a freight train 280 miles in length, comprising 28,000 carloads, or would be sufficient for the building of a fence six feet high and 1,500 miles long. . . . The magnitude of the present purchases may be realized from the fact that the total amount of lumber bought by the Army during the last year was but 2,000,000,000 board feet.[64]

Continuing at a brisk pace, M&E rolled up impressive totals for January: nearly 4,000 boilers and water heaters; roughly 4,000 furnaces and stoves; 7,000 squares of roofing material; 240,000 kegs of nails; 10 million square feet of plywood and wallboard; and 850 million board feet of lumber—at a total cost of $35.5 million. During this same period, the Supply Division, OCE, under Colonel Fowler's direction, purchased $7.6 million worth of service equipment and other items for construction projects. Speaking before the West Coast Lumbermen's Association at Portland, Oregon, on 30 January, Colonel Styer pronounced the operation a success.[65]

Meanwhile, screams of protest were coming from the field. Deliveries were scheduled improperly. Some projects were swamped with lumber, while others had virtually none. Many lots were green or warped and many contained random lengths. Orders were frequently shipped short. "Organized delay and confusion" was Sturgis' descriptive phrase. Contractors, who believed they could do a better job themselves, laid the blame on centralized procurement. Division and district engineers joined in condemning M&E.[66] Typifying their attitude was Colonel Scott's complaint: "If they can't work out some system . . . , they ought to stop that central purchasing. It is a mess and something ought to be done about it."[67] Taking a firm line, Colonel Groves declared: "Whether we like it or not or whether the people in the field like it or not, we've got to have centralized procurement."[68] The fuss continued. On 31 January Groves telephoned Farrell, who was spending a few hours at his home in Albany: "I'm having a terrible time here. All those lumber boys that don't know how to handle central procurement, and can't make any estimates, and can't do anything else."[69]

Farrell offered a suggestion: "I think what we need is some flexibility, we want simplicity, and we want to make sure there is ample supply in ample time. I see no objection in having the contractor purchase a million, two million, two and a half million board feet on any job." Raising another point, whether a district engineer "could make these bills of materials," he told Groves, "I don't think he can."[70] Together, the two men worked out a more flexible procedure and persuaded Nelson to O.K. it. At the start of a job, the contractor would

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[63] Memo, W. V. Kahler, OPM, for Madigan, 15 Jan 42. Madigan Files, Cantonments—Troop Housing, Current Data.

[64] WD Press Release, 12 Jan 42. EHD Files.

[65] (1) Constr PR 47, 15 Mar 42, p. 243. (2) OCE Press Release, 31 Jan 42. Opns Br Files, Lumber.

[66] (1) Opns Br Files, Lumber. (2) Sturgis Comments, V, 2.

[67] Tel Conv, Scott and Antes, 22 Jan 42. Opns Br Files, San Jacinto, Galveston, Tex.

[68] Tel Conv, Groves and Scott, 23 Jan 42. Opns Br Files, Lumber.

[69] Tel Conv, Groves and Farrell, 31 Jan 42. Opns Br Files, Lumber.

[70] *Ibid.*

purchase 10 percent of the project's total lumber requirement; then, M&E would buy the balance. Farrell, Reed, and other members of Groves' staff logged a lot of travel time, going to various districts and explaining central purchasing techniques. Gradually, the uproar subsided. There was still some grumbling from the field, but the worst appeared to be over.[71]

The volume of Reed's purchases dropped as local procurement offices stepped up their activities. Between 1 February and 30 April 1942, M&E acquired 860 million board feet of lumber, only slightly more than the total for the single month of January.[72] Meanwhile, district engineers increased their exertions. Sturgis' operations at Vicksburg exemplified their methods. Regarding anything received from M&E as so much "gravy," he sent agents all over the country to buy up stocks of materials, made personal appeals for help to old friends in the lumber industry, and persuaded the purchasing departments of big contractors, including the outstanding firm of J. A. Jones, to assist projects other than their own.[73] Going far beyond this, some district and area representatives attended M&E's lumber auctions to make separate, backstairs deals with vendors. "In their zeal to get on with the job for which they were responsible," Colonel Sherrill related, "they would circulate among the lumber dealers and tell what their own requirement was. Of course, when it was 'easy' business, they had no trouble finding a responsible saw mill which would fill the order."[74] Fairly widespread in the early months of the war, such dealings tended to undermine Reed's efforts.

Overshadowing the question of procurement methods were problems of priorities and allocations. With so many construction staples in short supply, the rate of progress at the job sites depended largely on priorities fixed by ANMB within broad policies laid down by the War Production Board. Under the rating pattern followed during the first six months of the war, AA was the top priority and the A–1 classification was subdivided into A–1–a, A–1–b, and so on down to A–1–j. Priorities assumed greater importance as more and more commodities came under allocation control. Beginning in November 1941 with steel plate, the list of allocated items grew to include rubber, virtually all the basic metals, and many end products, among them service equipment and heavy construction machinery.[75]

Military construction was far down the list of most urgent programs. Top priorities went to aluminum, high octane, and synthetic rubber plants and to naval vessels. The rating for warships was extended to the Navy's shore installations on the grounds that they were essential to support the fleet. Army munitions projects were rated A–1–a or A–1–b. Airfields had to get along with A–1–e priorities, and cantonments with A–1–j. Navy recruiting stations took precedence over Army Ordnance plants. So weak was the priority for camps and

[71] (1) Memo, Reed for WPB, 2 Feb 42. 411.1 Part 2. (2) TWX, Reybold to Div Engrs, 10 Feb 42. 411.1 Part 2. (3) TWX, Reybold to Div Engrs, 17 Feb 42. 411.1 Part 2. (4) Opns Br Files, Lumber.

[72] Constr PR 53, 15 Jun 42, p. 306.

[73] Sturgis Comments, V, 2 and VI, 3.

[74] Col. Fred G. Sherrill, Lumber in the War (MS), I, 8.

[75] (1) Smith, *The Army and Economic Mobilization*, p. 534 and ch. XXIV. (2) *Building the Navy's Bases*, Vol. I, pp. 89–93.

cantonments, that in April 1942 General Reybold warned ANMB: "Increasing difficulties being experienced in obtaining materials make it certain that the currently authorized troop housing program cannot be completed within the time specified with this comparatively low priority rating."[76] From the earliest days of the war, the Engineers exerted unremitting pressure for higher ratings. "We have fought and bled for priorities," General Robins said in May 1942.[77] But success nearly always took the form of spot priority assistance—special ratings for individual items at particular projects—rather than higher blanket priorities for entire programs.

Too frequently, spot priorities merely robbed Peter to pay Paul, diverting scarce supplies from one Engineer project to another. An experience related by General Sturgis was illuminating. Within the Vicksburg District were two urgent projects delayed for want of 12-inch cast iron pipe. One was an Air Forces navigation school at Monroe, Louisiana; the other, an ammonia plant at El Dorado, Arkansas. Finally, after a good deal of pressure by the Air Forces, the Monroe job received priority assistance. Because the El Dorado plant was critically important, Sturgis visited the site and spent the day on the telephone with production authorities in Washington, at length extracting a promise that he would get the pipe. He told the rest of the story in these words:

> Reaching Vicksburg that same night about 11 P.M., I went to my office to review the "hot" mail, which was left on my desk on days I was out of town. There I found two wires from the WPB.
>
> The first wire read something like this: "This confirms telephone approval of priority for 12-inch pipe for the El Dorado Ordnance Plant."
>
> The second wire read: "Priority recently granted Monroe Air Corps Base for cast iron pipe disapproved since this pipe is needed for the El Dorado Ordnance Plant."

Sadly, he concluded that the left hand knew not what the right hand did.[78]

When priorities failed, the Engineers fell back on their own devices, expediting and improvisation. In Washington and the field, construction officers kept a sharp watch for signs of trouble. At the first hint of difficulty, they swung into action. Reed's expediters crossed paths with expediters from districts and divisions. Traveling from plant to plant, from lumberyard to warehouse, these men carried a stick in one hand and held out a carrot with the other. "Waste a minute, lose a life," Sherrill summed up their philosophy. "Try to save a dollar, waste a minute, lose a life."[79] Meanwhile, the field was resorting to expedients in order to lick supply problems. Some district engineers purchased abandoned buildings and stripped them of equipment and usable materials. Some bought many items second hand. One, unable to obtain structural steel for elevated water tanks, dug a reservoir, lined it with concrete, and roofed it over to keep out dust and contamination. Another adopted a hangar design calling for glued laminated plywood arches and collapsible doors which needed no heavy structural support.[80] And so the story went: perseverance and invention.

[76] Memo, Reybold for ANMB, 16 Apr 42. 652 I.

[77] Min, Engr Production Conf, 22 May 42, p. 44. 337 (Engrs, Corps of).

[78] Sturgis Comments, XVII, 2.

[79] Sherrill, Lumber in the War, I, 4.

[80] (1) Memo, Eberstadt for Patterson and Forrestal, 1 Feb 42. USW Files, Misc and Sub, Steel. (2) Sturgis Comments, VIII, 2. (3) *ENR*, May 7, 1942, pp. 68–70.

The temptation was always strong to use materials readily at hand, however critical. Reportedly, on one occasion the Engineers succumbed. In April 1942, Rexford Newcomb, a ceramics specialist for WPB, complained to Reybold that the field was flagrantly violating an OCE order which prohibited use of metallic cable. Robins was aware of the situation but had done nothing about it; that, said Newcomb, was an example of the "complete lack of cooperation we are getting."[81] Disturbed by these allegations, the Chief investigated. From the Louisville District, Col. Henry Hutchings, Jr., reported that one project under his control had used metallic cable. The contract for electrical work at Camp Atterbury, Indiana, had gone into effect 17 days before the OCE order appeared. In the interests of speed, Hutchings had let the contract stand.[82] Other district engineers pleaded not guilty. Satisfied the Corps was in the clear, Reybold denied Newcomb's charges. "This is the first time this Department has been accused of failure to cooperate with the War Production Board," he told Nelson.[83] In a conciliatory vein, Nelson replied: "We are well aware of the general effectiveness of the restrictions imposed by the Corps of Engineers on the use of critical materials."[84] Unfortunately, the matter did not rest there. A few months later, the Washington *Daily News* carried an account of the affair that repeated Newcomb's allegations almost word for word.[85]

Second only to problems of materials were problems of construction machinery. As head of the Mechanical Equipment Unit, Maj. Robert L. Richardson faced a challenge only slightly less formidable than the one that confronted Major Reed. Shortages of cranes, shovels, dozers, draglines, and the like, already serious in 1941, turned critical after Pearl Harbor, as combat and lend-lease claimed a major share of industrial output. A year or more of multiple shifts, bad weather and good, had taken a terrible toll of equipment. The existing plant was generally in poor repair and contractors were clamoring for replacements. Resistance to third-party leases, which contained recapture clauses, was increasingly strenuous. Shortages of tires and gasoline were added complications. As the war continued, the situation was likely to deteriorate still further.

Prospects for obtaining new equipment worsened steadily. An order placed by the Ordnance Department in December 1941 for 4,000 D–6's and D–7's would claim the output of all crawler tractor plants for a six-month period. Requirements for Engineer and other service troops, for overseas bases, for the Navy, the British, the Russians, and other high-priority users imposed a crushing load on manufacturers of every type of construction machinery. By January 1942 deliveries of cranes and shovels were running about three months behind, and even to place an order required a preference rating. A plan to convert segments of the industry to tank production, though mercifully deferred, was un-

[81] Memo, Newcomb for Reybold, 16 Apr 42. 410 I.

[82] (1) Telg, Reybold to Div Engrs, 22 Apr 42. 600.1 Part 13. (2) Ltr, Reybold to Newcomb, 22 Apr 42. 410 I. (3) Ltr, Hutchings to Daley, 22 Apr 42. 652 (ORD).

[83] Ltr, Reybold to Nelson, 6 May 42. 410 I.

[84] Ltr, Nelson to Reybold, 26 May 42. 401.1 Aug 41–Feb 43.

[85] Washington *Daily News*, 3 Aug 42, pp. 2, 16.

mistakably portentous.[86] As time went on, more and more contractors found themselves in desperate straits. Describing the situation in the Los Angeles District eight weeks after Pearl Harbor, Colonel Kelton appealed to the Chief's office to "alleviate the present critical shortage of heavy construction equipment which is seriously affecting progress on existing contracts and which, it is already apparent, is adversely affecting competitive bidding on new work."[87] The pinch grew tighter. In April 1942, the *Engineering News-Record* carried the report: "Only about 15 percent of the output of the equipment manufacturers now reaches contractors or rental distributors, the rest going to equip army and navy combat units or to lend-lease."[88]

The developing equipment shortage was reflected in directives calling for the choice of sites that required little grading. "One of the greatest consumers of construction equipment," Robins reminded the field, "is the item of earth moving, which at many locations has assumed staggering proportions."[89] Unfortunate examples cited by inspectors served to emphasize the need for level, well-drained sites: for instance, at the Keystone Ordnance Works, a railroad connection required "many miles of construction, some over swamp, some through deep cuts, and part over an enormous 45-foot fill"; and at Pine Bluff Arsenal, "from one to five feet of poor top soil" had "to be mucked out to provide a solid base for roads."[90] How important the Engineers considered this aspect of wartime site selection was suggested by an incident related by General Plank. In the spring of 1942, the Air Forces picked a location along the Mississippi River, north of Memphis, for a large training installation. On reviewing the Engineer site report, Plank saw that the job would entail moving "something on the order of 3,000,000 cubic yards of earth." He continued the story:

> I said, "You simply can't get that project built. There simply isn't enough construction machinery. You can pick it, but you'll never get it done in time." And that made the Air Force so damn mad that they asked that I be relieved. O.K. You don't get bulldozers and draglines and what not by relieving me or anybody else. . . . I just had to take the position that the site itself had to be disapproved, and finally made it stick.[91]

The Corps vetoed a number of other sites for the same reason and made the vetoes stick.[92]

While they tried to pare requirements, the Engineers also sought to bring every available piece of equipment to their projects; they appealed to state, county, and municipal works departments for pavers and graders; they put pressure on contractors to "scour the backroads" for machinery; they urged farmers to lease idle tractors and trucks during the off season; and they even put plows and cultivators to use at airfield projects.[93]

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[86] (1) Memo, Richardson for Groves, 19 Dec 41. Opns Br Files, Rental Equip. (2) Madigan Files, Steam Shovel Data. (3) *ENR*, February 26, 1942, p. 35; and April 16, 1942, p. 5.

[87] Ltr, Kelton to OCE, 31 Jan 42. 400.1301 Part 4.

[88] *ENR*, April 23, 1942, p. 172.

[89] OCE Circ Ltr 1666, 2 Jun 42. See also OCE Circ Ltr 1190, 9 Feb 42.

[90] (1) Rpt of Insp by Strong, 6 Apr 42. Opns Br Files, Insp Rpts, Col Strong. (2) Memo, Davis for Strong, 22 Apr 42. Opns Br Files, Grnd Trps Sec.

[91] Plank Interv, 6 Dec 50.

[92] 686 (Airfields) Part 55.

[93] (1) TWX, Robins to Div Engrs, 11 Apr 42. 481 Part 1. (2) Ltr, Dist Engr, Seattle, Wash, to Div Engr, NPD, 4 May 42. 481 (Seattle DO) Part 1. (3) *ENR*, April 16, 1942, p. 5; and February 5, 1942, p. 3.

Armed with authority from Somervell to "transfer construction equipment from any military establishment under the jurisdiction of the War Department," General Reybold forced post commanders to send maintenance machinery, trucks, and automobiles to construction jobs.[94] Meantime, the tangle of difficulties surrounding third-party rentals was being unsnarled.

Always a sore subject with equipment owners, the recapture clause was a controversial issue in the War Department, where some viewed it as a safeguard and others, as a drawback. Deleted from the fixed-fee contract in the fall of 1941, the clause was still a standard feature of third-party rental agreements when the United States entered the war.[95] Increasing difficulty in renting from third parties and sharp rises in rental rates caused mounting concern. Judge Patterson seemed to think the remedy was at hand. Early in December 1941, he reminded Reybold that the Requisition Act was "on the books" and that the War Department was "no longer helpless in the matter."[96] But requisitioning was contrary to the Engineers' philosophy. Although they often mentioned the act as a bargaining point, they continued to do business on a voluntary basis. When Patterson insisted on retention and enforcement of the recapture provision, affairs went from bad to worse.[97]

On 10 March, at Major Richardson's prompting, General Robins appealed to Somervell for help. Setting forth the case against recapture, Robins wrote:

> As new construction equipment is now extremely difficult to obtain, the omission of the recapture clause would open new fields of rental, namely contractors without Government contracts. Contractors have been extremely reluctant to rent construction equipment whenever contracts contain the recapture clause.

Underscoring the urgency of his request, Robins pointed out that OPA would shortly establish price ceilings on third-party rentals and thus destroy whatever chance the Engineers now had of competing with the Navy, which made no provision for recapture in its agreements.[98] Somervell took the matter up with Patterson, who notified General Reybold: "The recapture clause will be required in all lease agreements as heretofore directed."[99] With customary persistence, Robins tried again. This time he went to Madigan, who soon set matters right. Patterson delegated authority to rent without recapture to Reybold, who, in turn, delegated it to the field.[100] A serious obstacle was out of the way.

With a huge inventory of recaptured equipment to control and maintain, the Engineers had a problem on their hands. Advancing a solution early in the war, Colonel Sturgis wrote the Chief: "There has evidently been a large amount of plant acquired by the United States . . . which should furnish a valuable

[94] SOS Ltr SPAD 400.22 (5-19-42), 9 May 42. Opns Br Files, SOS.

[95] See pp. 426-27, above.

[96] Memo, Patterson for Reybold, 3 Dec 41. USW Files, Misc & Sub—Equip.

[97] (1) 3820 (Nat Def) Part 12A. (2) TWX, Reybold to Div Engrs, 15 Jan 42. 400.7 Part 30. (3) 481 Part 1.

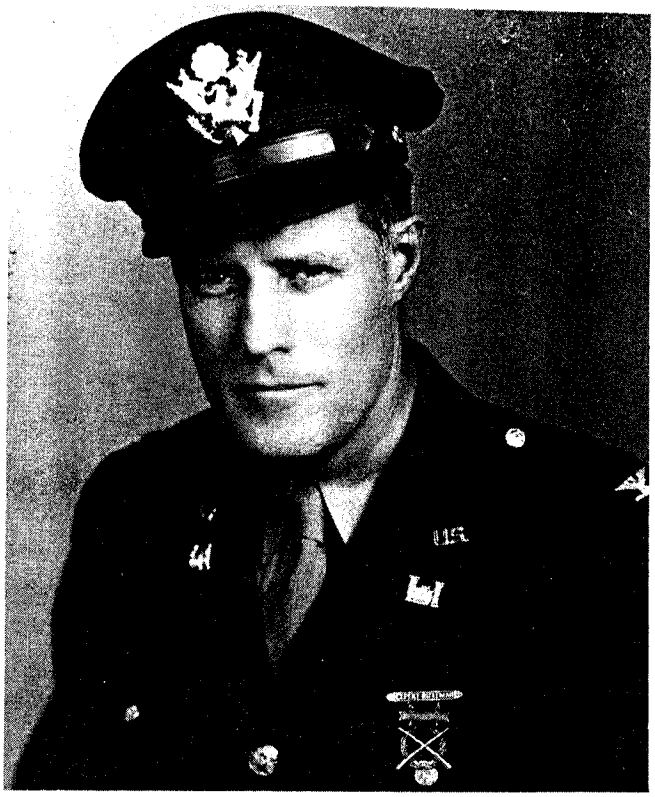
[98] Memo, Robins for Somervell, 10 Mar 42. 481 Part 1.

[99] Memo, Patterson for Reybold, 18 Mar 42. 400.13 Part 4.

[100] (1) Memo, Robins for Madigan, 27 Mar 42, and 1st Ind, 27 Mar 42, thereon. USW Files, Misc and Sub—Equip. (2) TWX, Strong to Div Engrs, 1 Apr 42. 481 Part 1. (3) TWX, Robins to Div Engrs, 12 May 42. 481 Part 1.

pool of equipment for future projects." He went on to suggest that the central office "act as a clearing house for immediate information as to availability and an authority for priority of use."[101] Reybold liked the plan. By spring each division had its own equipment pool. A network of giant repair shops was overhauling and rebuilding worn-out machinery. Special efforts were under way to procure spare parts, gasoline, and tires. Some of the best men in the equipment business were acting as consultants. And fleets of equipment were moving halfway across the country on Major Richardson's orders. Thanks largely to the pooling arrangement, relatively few projects were seriously hurt by shortages of equipment.[102]

Problems of materials continued to dwarf all others. As chief of M&E during the crucial summer of 1942, Colonel Sherrill had many woes. Nearly everything the Engineers needed was scarce. An ANMB directive creating a new AAA rating caused confusion and uncertainty. Almost hourly, calls came into M&E from projects in distress. Time and again, Sherrill bailed them out by diverting shipments from other projects, shifting orders from plant to plant, sending expediters to the scene, or wringing spot priorities from production authorities. Meanwhile, he tried to cope with general shortages of key commodities. By purchasing over a million kegs centrally, enough to meet requirements until February 1943, he overcame a scarcity of nails in the South and Southwest. By intensifying his search for abandoned tracks and obtaining a larger allocation of new rail from WPB, he eased a severe shortage of rail. When lack of steel interrupted production by the Timber Engineering Company of the vitally important connectors for wood trusses, he came to the rescue with an AA–2 priority.[103] Through it all, one concern was uppermost, a critical shortage of the basic commodity—lumber.



COLONEL SHERRILL

Lumber Crisis

On the first day of the new year, 1942, the *Engineering News-Record* carried the

[101] Ltr, Sturgis to Reybold, 18 Dec 41. 686 (Airfields) Part 46.

[102] (1) Memo, Robins for Styer, 31 Mar 42. 481 Part 1. (2) Min,Engr Production Conf, 28 Sep 42. 337 (Engrs, Corps of). (3) Memo, Richardson for Strong, 13 Jun 42. Opns Br Files, Memos—M&E Sec. (4) *ENR*, April 16, 1942, p. 5. (5) Tel Conv, Elliott and Antes, 4 Jun 42. Opns Br Files, Equip 2.

[103] (1) Opns Br, Daily Log, May–Sep 42. EHD Files. (2) Opns Br Files, Grnd Trps Sec; and Memos, ExecO, Constr Div. (3) 411.5 I.

headline: "Lumber supply adequate for war construction." A survey by the Timber Engineering Company had disclosed that "all requirements can readily be met." In February the magazine captioned an item: "War demand for lumber unlikely to cause shortage." The writer attributed to Styer the belief that "with prudent handling, . . . there should be enough lumber to meet all needs without rationing, including lend-lease shipments abroad." As late as 23 April, the *News-Record* could report that the latest WPB scarcity list made no mention of lumber.[104] Optimism was almost universal. The country's timber resources were practically limitless. During 1941, the total lumber supply, including imports, had amounted to 37 billion board feet, and domestic production had increased 14 percent over 1940. In December 1941 stocks on hand at mills and lumber yards approximated 17 billion board feet. Only the Forest Service warned of a possible shortage, and its warnings went largely unheeded.[105]

As critical as it was unforeseen, a lumber shortage developed suddenly in the spring of 1942. Early in April Major Reed detected a decided tightening of the market. The situation deteriorated rapidly as requirements shot upward not only for building construction but for airplane framing, ship decking and planking, boxes and crates, ponton stock, and lend-lease shipments as well. Worst of all, while demand rose sharply, production actually fell. Explaining the drop in industrial output, General Reybold cited a letter from "a dear old lady of the Deep South." After tracing her genealogy, the old lady offered him her favorite walnut tree. While praising her patriotism, Reybold declared: "She was under the erroneous impression that the dire need was for trees. This is not the case at all. It is the lack of manpower in the woods which causes the shortage of lumber." Contributing factors were scarcities of fuel, tires, and equipment.[106]

As the crisis deepened, Reed and his assistants fought doggedly to combat the shortage. They launched a campaign to purchase 250 to 300 million board feet from retail lumber yards. They arranged to borrow lend-lease stocks held by the British on the East Coast. Going into New England, they bought up all available hurricane lumber. Moving north of the border, they purchased all the Canadian lumber they could find. Meanwhile, they held auctions in Florida and Wisconsin, states which had not previously entered the supply picture. Little more than temporary expedients, these measures eased the pinch only briefly. At the end of April, Reed had a backlog of unplaced orders for 200 million board feet—orders the lumber industry was unable to absorb.[107]

During April the Chief's office studied proposals for increasing supplies of lumber by altering specifications. By accepting lower, rougher grades and by ordering random lengths and widths, buyers could reduce pressure on the mills. But the sacrifice in quality would be severe. Moreover, as Stratton pointed out, use of random sizes meant increased

[104] *ENR*, January 1, 1942, p. 24; February 5, 1942, p. 3; and April 23, 1942, p. 55.

[105] S Rpt 480, Part 14, 77th Cong, 2d sess (Dec 15, 1942), p. 2.

[106] Maj Gen Eugene Reybold, "They Deliver the Woods," *The Timberman*, June 1943, pp. 46, 10.

[107] Memo, Groves for Clay, 28 April 42. 411.1 Part 3.

waste.[108] The decision was not one to be taken lightly. After a good bit of soul searching, Zackrison gave the nod, and Urquhart, Stratton, Strong, and Groves in turn approved. By the first of May, new instructions were ready for the field: buy all two-by-twos and two-by-threes, all boards, all tongue and groove decking, all bridging, sills, plates, and headers in random lengths; specify sizable posts and timbers rough; and, because of its requirement for very long studs, avoid balloon construction. In general, all lumber except framing would be one grade lower than that normally specified.[109] At lumber auctions later on, Sherrill took a ribbing for buying "random, random, random." His retort was apt: "There is more to this than meets the eye. At a given moment, ten thousand people scattered throughout the country can cut 10,000 two-by-sixes, 24 feet long, in half a good deal quicker than half a dozen saw mills can cut the same 10,000 pieces in half."[110]

The Engineers took further steps to conserve lumber. Late in April Colonel Groves wired the field: "Make such modifications in structural designs of mobilization type buildings as are practicable." Narrower joists and simpler framing were examples of what he had in mind. On 13 May Colonel Stratton urged district engineers to substitute concrete floors for wood floors in warehouses, messhalls, administration buildings, and other one-story structures. A few days later, with the approval of The Surgeon General, he O.K.'d concrete floors for TO barracks. Before long, teletypes were on the way telling division engineers to build all interior partitions of wallboard.[111] More such changes followed. The purpose was always the same: to effect all possible savings of lumber through substitution and redesign.

The question naturally arose: if lumber was hard to get, why not use more structural clay? Masonry interests, long dissatisfied with their share of the program, took this opportunity to press their case. Manufacturers, individually, through their trade associations, and through their congressmen, besieged General Reybold with demands for increased use of their products. As before, the Chief offered assurances that clay products would receive every consideration, but he declined to make a basic change in policy. The old arguments against masonry still held good: too costly and too time-consuming. In many areas skilled masons were none too plentiful.[112] Moreover, as Groves explained: "With the experience that we had had with bricklayers, there was every natural reluctance to turn to masonry if its use could be avoided."[113] Since 1941 the field had had authority to substitute brick, tile, or concrete blocks for wood where the difference in cost and completion time was not excessive. In the absence of more definite instructions, district engineers had to decide for themselves what was

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[108] Memo, Stratton for Strong, 8 April 42. Opns Br Files, Memos–Engrg Br.

[109] (1) Zackrison Interv, 19 Feb 65. (2) TWX, Groves to Div Engrs, 30 Apr 42. 652 (NAD). (3) OCE Circ Ltr 1556, 2 May 42.

[110] Sherrill, Lumber in the War, I, 3.

[111] (1) TWX, Groves to Div Engrs, 30 Apr 42. 652 (NAD).(2) TWX, Stratton to Div Engrs, 13 May 42. 400.8 Part 2. (3) Ltr, Hill to TSG, 20 May 42. 621 Part 1. (4) TWX, Reybold to Div Engrs, n.d. 400.8 Part 2. (5) TWX, Reybold to Div Engrs, 13 Jun 42. 411.8 Part 1.

[112] 411.8 Parts 3 and 4.

[113] Groves Comments, X, 7.

excessive. While some used masonry freely, most continued to prefer wood.

While others concentrated on conserving lumber, Groves tackled the problem from a different angle. On 28 April, at Reed's suggestion, he asked General Clay to petition the War Production Board for a freeze order, "prohibiting the sale of lumber to retailers or direct by producers to any but defense purposes."[114] On 13 May Chairman Nelson complied. A week later, the *Engineering News-Record* informed its readers: "The order applies to softwood 'construction lumber' produced by mills whose production during the past three months has averaged more than 5,000 board feet per day. Such mills are forbidden to sell except to the Army, Navy, and Maritime Commission, or their contractors."[115] Along with the order, Nelson issued instructions that lumber for all Engineer projects requiring in excess of one million board feet would be procured centrally. He coupled this action with an appeal to loggers and sawmill operators to step up production.[116]

All these measures notwithstanding, difficulties increased with the advent of summer. On 29 June Walter T. Deadrick of M&E's lumber unit informed Colonel Sherrill: "Our inability to place orders for our lumber requirements . . . has now reached a very critical point." Auctions were having disappointing results. At Portland, Oregon, the week before, bidders had walked out, leaving orders for 60 million board feet still unplaced. Since 22 June, another buy had been in progress, "days, nights, and Sundays," at the Peabody Hotel in Memphis, but M&E had yet to purchase for forty projects. Heavy buying in Wisconsin and Florida had exhausted cuttings in those states for weeks to come. Over the country as a whole, said Deadrick, production was "about 15 percent off because of a shortage of tires, labor, and supplies." He continued:

> Weather conditions have been particularly bad in all lumber producing areas this spring and summer; the demands of the boxing industry are conflicting increasingly with our program; the regulations issued by the Office of Price Administration are hampering production; the uncertainties of price ceilings and their interpretations are causing vendors to hesitate in accepting commitments; and, to a somewhat minor degree, the shortage of competent and trained help is preventing us from securing all of the lumber which might be located.[117]

At project level, the pinch was becoming tighter. The number of delays caused by lumber shortages rose steadily—from 88 in May, to 95 in June, to 101 in July.[118]

Division and district engineers showed initiative in finding lumber to keep their projects going. The work of General Hannum and Lt. Col. Robert C. Hunter, the district engineer at Sacramento, was an example. On a trip through the Sierras, they noticed a number of small sawmills deep in the woods. At Hannum's suggestion, Hunter sent men into the mountains in search of mills having no government orders. The scouts located quite a few. By contracting for their output, which averaged twenty to thirty thousand board feet per day, Hunter was able to keep most of his jobs on

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[114] Memo, Groves for Clay, 28 Apr 42. 411.1 Part 3.

[115] *ENR*, May 21, 1942, p. 56. See also TWX, Reed to Div Engrs, 14 May 42.

[116] (1) OCE Circ Ltr 1587, 11 May 42. (2) *ENR*, May 14, 1942, p. 2.

[117] Memo, Deadrick for Sherrill, 29 June 42. Opns Br Files, Lumber.

[118] Summaries of Delaying Factors, May–Jul 42.

schedule. Hunter's methods were by no means unique. Engineer projects throughout the South drew heavily on the thousands of "peckerwood" or "coffee pot" mills which dotted the great pine-producing region.[119] The chief difficulty was not in locating these small mills and giving them orders. Rather it was in keeping them from going under.

At a WPB conference on 9 July, Sherrill put forward a plan to aid small producers. "East of the Plains," he said, "sixty-five percent of the lumber is produced by mills cutting 20,000 feet or less daily." High operating costs were forcing many of these operators out of business. Countrywide, labor was critical. Lumberjacks were leaving by the thousands for higher paying jobs in cities. To relieve the situation, Sherrill proposed that the government pay a bonus of two dollars for every thousand board feet of lumber cut, the bonus in no case to exceed $15,000 a year.[120] When he first heard about the plan, General Clay was heartily in favor of it, but after consulting his legal advisers, he withdrew his support. A bill to provide a bonus for mill operators would have the appearance of "discriminatory class legislation," Clay's attorneys told him, and Congress would probably reject it as such.[121]

As the lumber famine persisted, Colonel Robinson asked Somervell to take a hand. Noting that production had fallen off alarmingly, the SOS control officer told his chief on 12 August: "Bills have been introduced, orders have been issued, committees have been formed, resolutions have been passed, *but less timber is being cut.*" WPB estimates put total production for 1942 at 33 billion board feet as against requirements of 38.7 billion. Reserve stocks were 18 percent below last year's level. Log production on the West Coast was off 10 percent, and important western planing mills were closing for lack of workers. Southern pine loggers, heavily dependent on truckers, were seriously hurt by shortages of tires. Many southern mills were operating below capacity, and ceiling prices were forcing marginal producers to the wall. A bad situation was made worse by the lumbermen's inability to replace worn-out equipment or even to obtain spare parts. After reviewing various proposed remedies—bonuses, subsidies, pay boosts, additional overtime, draft deferments, hikes in ceiling prices, and priority assistance—Robinson suggested that the Army organize logging battalions and send them into the woods. Something had to be done and done fast, he warned. The shortage was jeopardizing not just the Army program but the entire war construction effort.[122]

If the Engineers had too little lumber, other war agencies had appreciably less. In a sellers' market that was increasingly congested and confused, conventional government purchasing methods were largely ineffective. The Engineers, with their auction system, enjoyed a huge advantage. By the summer of 1942, according to Colonel Sherrill, "they were getting the bulk of the lumber, and the

[119] (1) Ltr, Hannum to Robins, 19 Sep 42. 411.1 Part 3. (2) Sherrill, Lumber in the War, IV, 11–12.

[120] Memo, Sherrill for Clay, 10 Jul 42. 411.1 Part 3.

[121] (1) Opns Br, Daily Log, 13 Jul 42. (2) Memo, Legal Sec, SOS, for Clay, 31 Jul 42. 411.1 Part 3. (3) Memo, Clay for Sherrill, 6 Aug 42. 411.1 Part 3.

[122] Memo, Robinson for Somervell, 12 Aug 42. OCE, Proc Div, Lumber Br Files, Centralized Purchases.

other branches in the Army and all the bureaus in the Navy were merely following in their wake—in effect, picking up little odds and ends that dropped out of the enormous haul of the Engineers." Also trailing in the wake were the Maritime Commission, the Defense Plant Corporation, and other war agencies.[123] The Engineers came in for heavy criticism, as the impression gained that they had cornered the market.

> Because the Engineer method was efficient and functioned cooperatively with lumbermen, battling almost insuperable odds [Reybold commented], these lumbermen declined to sell their product to other agencies through the long and complicated procedures ordinarily used. The fact that other agencies could not purchase lumber was not due, then, to any monopoly the Engineers held, but solely to the lumberman's own choice of those with whom he would do business.[124]

From time to time, Sherrill extended a helping hand to other agencies, by placing orders for them at his lumber buys. But, admittedly, he did so "perhaps a little grudgingly" and only when "the purchase would not too greatly interfere with the Engineers' own requirements."[125]

An appeal from Admiral Moreell to General Somervell in mid-August 1942 dramatized the plight of the other agencies. Construction of the great floating dry docks which would play a vital role in the war at sea was just getting under way. Needed for the purpose was 25 million board feet of Douglas fir of a special grade, size, and fiber stress. The Navy asked M&E to make the purchase. This request coincided with calls for the same type of lumber from Army projects at the Oakland and Boston ports. After placing the Army's orders, Sherrill was unable to place the Navy's. "In spite of every effort, and they did make many efforts," he said, "the Engineers could not find a home among lumber producers for the three requirements within the time limits imposed." Protesting naval officers took the matter to ANMB Chairman Eberstadt, who called in Colonel Sherrill.

> This contest [Sherrill related] was so important and involved so much of what was even then felt to be of far reaching consequence that Mr. Eberstadt had practically all of the high ranking members of ANMB present. We ended up day after day, however, at the same place—nowhere. . . . Admittedly, the Navy had to have the lumber, still there was no one in the lower levels of the Corps of Engineers with authority to set aside its requirements to meet this conflicting demand of the Navy.

Finally, someone suggested that Moreell telephone Somervell—which he did. Somervell, in turn, called Reybold. Could the Corps of Engineers fill the Navy's requirement? Reybold countered with a question of his own. Would Somervell risk delaying the port projects? Somervell agreed to take the risk and Reybold turned over the lumber. The affair had made a deep impression on Eberstadt. Clearly, this was no way to win the war.[126]

Turning for advice to one of the country's top lumbermen, Eberstadt asked Frederick K. Weyerhaeuser to survey the situation and suggest a remedy. On 18 August, after a six-day in-

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[123] Sherrill, Lumber in the War, II, 4.

[124] Reybold, "They Deliver the Woods," *The Timberman*, June 1943, p. 12.

[125] Sherrill, Lumber in the War, II, 6.

[126] *Ibid.*, II, 6–8. See also Memo, Robinson for Somervell, 12 Aug 42; and Memo, Rear Adm T. J. Keleher, ANMB, for Reybold, 18 Aug 42. 411.1 Part 3.

vestigation, Weyerhaeuser submitted his report. He attributed much of the difficulty to cutthroat competition for limited supplies. "Each agency," he wrote, "has obviously regarded its own requirements as of sole importance as contrasted to the requirements of the Army and Navy as a whole." The result was "confusion and lessened production." Weyerhaeuser's solution was unprecedented—to consolidate all purchasing in a single organization. He further recommended that ANMB set up a Lumber Allocation Committee to control distribution among the branches and bureaus of the Army and Navy.[127] After reading the lumberman's report, Eberstadt fell to work. His first move was to send for Colonel Groves.

Recalling his visit to Eberstadt's office, Groves stated:

> The facts are that on one afternoon at about 2 o'clock, the Army-Navy Munitions Board asked me to meet with them and work out a procedure for the procurement of lumber. I was accompanied by Colonel Sherrill . . . and, I think, one civilian employee. The query was raised by Mr. Eberstadt as to whether the Corps of Engineers could take over all the purchasing of lumber for the Army and Navy and Maritime Commission. Mr. Eberstadt explained to me that apparently we had cornered the market and that the lumber industry was willing to sell to us and not to the others. He asked me if I felt we could do this. I assured him I thought we could handle it. He then asked me to meet with all the interested parties, including the separate bureaus of the Navy, in order to arrive at a satisfactory procedure.[128]

The ANMB Chairman had a final question: could Colonel Groves have everything lined up within 24 hours? Groves said he could. Thereupon, Eberstadt adjourned the meeting until 3 P.M. the following day.[129]

Groves had to work fast. On the way back to his office, he mapped out a course of action. Within an hour or two, a meeting was in progress with representatives from the Maritime Commission, the bureaus of the Navy, and other branches of the Army. The atmosphere, Colonel Sherrill reported, was "far from friendly":

> The bitter and intense debates of the past few weeks were still fresh in everyone's mind. Distrust was in evidence on every side. The other branches of the Army looked with just as fishy an eye at the Engineers, and anything the Engineers proposed, as did the Navy representatives. All had had their troubles with lumber. All had run afoul of the Engineers. None felt that any of the others could be trusted, least of all the Engineers.[130]

After proposing a real joint undertaking, Groves adjourned the meeting until the following morning at nine. That evening Deadrick and his staff worked late, designing what was to be the new Central Procuring Agency (CPA).[131] At the meeting next morning, Groves unveiled the plan. Discussion started off on the right note, when someone pointed out that the first to suffer under the new arrangement would be the Engineers themselves. The session was a long one.[132] But when it ended, Groves had the necessary concurrences. That afternoon he told the Board "that the matter was under complete control and that

[127] Memo, Weyerhaeuser for Eberstadt, 18 Aug 42. USW Files, 411.1 Lumber.

[128] Groves Comments, VI, 11.

[129] Sherrill, Lumber in the War, II, 9–10.

[130] *Ibid.*, II, 10–11.

[131] Draft Proposal [18 Aug 42]: Central Lumber Procurement. Opns Br Files, Lumber.

[132] Sherrill, Lumber in the War, II, 11–12.

there would be no shortage of lumber for any of the agencies from then on."[133]

On 20 August Eberstadt reported to Patterson and Forrestal. "In order to get the lumber situation in hand," he was moving to centralize procurement for the Army, Navy, and Maritime Commission in one organization—the Construction Division of the Corps of Engineers. He was also creating an ANMB Lumber Advisory Board to referee disputes among the services and to maintain liaison with the War Production Board. J. Philip Boyd of the Weyerhaeuser Company would head the advisory group. Although some details were still vague—other agencies would probably "be brought into this picture"—Eberstadt asked approval of the action taken thus far.[134] Patterson and Forrestal accepted the plan in principle, and so did Donald Nelson.[135]

Arrangements were soon complete. At the insistence of the Bureau of Yards and Docks, Eberstadt established a three-man Lumber Advisory Board to rule on questions of priority. Members were Francis H. Van Riper (Maritime Commission), Commander Oscar L. Carlson (Navy), and Colonel Sherrill (Army). Boyd was consultant to the group. On 1 September 1942 ANMB formally designated M&E as the Central Procuring Agency. Shortly, the War Shipping Administration, the Veterans' Bureau, the Defense Plant Corporation, the U.S. Coast and Geodetic Survey, and lend-lease also turned their lumber buying over to the Engineers.[136] Explaining the new setup to Colonel Farrell, Groves said: "The Navy wasn't getting anything at all. And now I think we are going to be able to supply them all right . . . . I don't anticipate any trouble, except, of course, it is a big headache." Pleased with the recent turn of events, he could not resist adding: "It was quite a compliment to us to have them come with their hat in their hand and say, 'Please, will you get our lumber for us?' "[137]

Establishment of CPA triggered another crackdown on the field. On 1 September General Reybold wired division engineers: henceforth M&E would buy all lumber. He left the field two loopholes, but they were relatively small: temporary authority for local purchases of up to one carload, and no prohibition on buying from retailers and distribution yards.[138] Division engineers reacted sharply to the Chief's message. Pointing out that small mills could not afford to send representatives to Sherrill's auctions, General Hannum made it clear that he would continue to buy from them direct.[139] Alarmed lest he lose the right to buy any lumber locally, Colonel Farrell protested to Groves: "Without that leeway, we would be completely bogged down." It was not the Chief's intention to impose unreasonable restrictions on the field.[140] Division and district engineers continued throughout

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[133] Groves Comments, VI, 12.

[134] Memo, Eberstadt for Patterson and Forrestal, 20 Aug 42. USW Files, 411.1 Lumber.

[135] (1) Memo, Patterson for Eberstadt, 22 Aug 42. Same File. (2) Opns Br Daily Log, 24 Aug 42.

[136] (1) Sherrill, Lumber in the War, II, 11–15. (2) ANMB Orgn Order 12 (Rev.), 1 Sep 42. (3) Opns Br Files, Lumber.

[137] Tel Conv, Groves and Farrell, 3 Sep 42. Opns Br Files, MAD.

[138] TWX, Reybold to Div Engrs, 1 Sep 42. 411.1 Part 3.

[139] Ltr, Hannum to Robins, 19 Sep 42. 411.1 Part 3.

[140] Tel Conv, Groves and Farrell, 3 Sep 42. Opns Br Files, MAD.

TABLE 18—LUMBER PURCHASED BY CPA, 1942–1945

Agency	FBM	Cost
Totals	25,926,537,283	$1,328,980,200
War Department	19,480,160,224	1,000,723,579
Navy Department	4,745,219,959	226,849,085
Maritime Commission	492,570,086	25,477,618
Defense Plant Corporation	78,091,412	3,926,376
War Shipping Administration	39,361,319	1,731,293
Panama Canal	38,032,223	2,301,461
Distribution Yards	556,491,383	30,526,721
Treasury–Lend-Lease	343,051,475	25,873,446
Veterans Bureau	3,935,781	195,200
Miscellaneous	149,623,421	11,375,421

Source: Sherrill, Lumber in the War, Appendix J.

the war to pick up small lots of lumber. Nevertheless, after 1 September 1942, M&E made all large purchases.

Sherrill and company "delivered the woods." Within a week after the creation of CPA, Deadrick had found homes for a number of large orders the Navy had been trying unsuccessfully to place for several months. By mid-September Sherrill could report purchases of 650 million board feet "so far this month." Meantime, he disclosed, negotiations were in progress to import lumber from Mexico and Brazil. Before the year was out, a nationwide network of distribution yards was operative and a special office at Portland, Oregon, had taken over the buying of Douglas fir for the Navy.[141] Functioning effectively throughout the war, the Central Procuring Agency compiled an impressive record. By V–J Day it had spent more than 1.3 billion dollars for almost 26 billion board feet of lumber. (*Table 18*) The retention of CPA as a permanent part of the postwar defense establishment testified to its success.

But despite centralized procurement, the critical shortage persisted. Lumber became increasingly scarce as the war continued. From the fall of 1942 on, Sherrill had to face a steadily widening gap between supply and demand. He could purchase no more lumber than the industry produced; and production did not catch up with requirements while the war lasted.

The Last Ounce

The battle for building materials reached its climax in the summer and fall of 1942. As more and more war plants went into production, as buildups accelerated in Great Britain and Australia, as preparations went forward for large-scale offensives, the war entered a new phase. As far as construction was concerned, the term "critical materials" was outmoded, for, as Zackrison as-

[141] (1) Opns Br Daily Log, 7 and 18 Sep 42. (2) Ltr, Robins to Hannum, 2 Oct 42. 411.1 Part 3. (3) OCE Annual Rpt, 1943, pp. 44–45.

serted, the problem was no longer "one of *critical materials* but rather the conservation of *all materials*."[142] Under the spur of necessity, General Robins ordered drastic steps to reduce the strain on supplies: lowering safety factors; taking over hundreds of hotels and apartment houses; making greater use of masonry; and, over the objections of The Surgeon General, double bunking barracks. All these measures had serious drawbacks. Their adoption was proof of the Corps' determination "to squeeze the last possible ounce of precious war materiel off the construction program."[143]

The collapse of several structures at Fort MacArthur, California, when 14-inch railway guns fired test volleys there in the spring of 1942, underscored the danger of lowering safety factors. Dating from an earlier period, the buildings at MacArthur were a good deal sturdier than most of the new ones that were going up. To disregard this warning took considerable courage. But after wrestling with the problem and talking it over with Major Hill, Zackrison came to the conclusion—safety factors would have to be lower. At his insistence, designers increased stresses, spaced studs and rafters farther apart, and specified shorter, lighter members. The gamble was successful. The structures, unsubstantial though they were, held up for the duration of the war.[144]

More widely discussed than Zackrison's decision was a change in the policy on brick and tile. As the lumber crisis worsened, pressure for heavier reliance on masonry intensified. In July Madigan suggested to General Clay that it might be desirable to substitute "alternate materials" for wood.[145] A month later John L. Haynes of WPB reminded General Robins that production of brick and tile was "considerably in excess of demand."[146] Meanwhile, manufacturers of clay products, stepping up their campaign for a larger share in the Army program, hurled wholesale charges of discrimination at the Engineers.[147] An inquiry by Senator Walter F. George on behalf of the Standard Brick and Tile Corporation of Macon, Georgia, helped bring matters to a head. Predicting that their plant would soon have "to close down on account of the competition . . . with an inferior product (lumber)," Standard told the Senator that 450 men would be thrown out of work, "notwithstanding that lumber is scarce and very high and burned clay products have been abundant and selling at much lower prices."[148] In mid-August General Robins unveiled plans to "expand utilization of masonry construction."[149] How far he intended to go in this direction was not immediately clear.

Late in August Groves took up the question. Calling in Colonel Daley, he asked for a résumé of the Corps' experience with masonry on ground forces projects. At the same time, he asked Colonel Stratton to comment from an

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[142] Address by Zackrison, 14 Oct 42.

[143] Address by Col Fowler, 27 Mar 42.

[144] (1) Tel Conv, Groves and George, 29 May 42. Opns Br Files, MD–Dists. (2) Zackrison Interv, 27 Apr 65. (3) OCE, *Engineering Manual*, 1942, ch. XI.

[145] Memo, Madigan for Clay, 14 Jul 42. Madigan Files, SOS, Misc Memos.

[146] Memo, Haynes for Robins, 10 Aug 42. 411.8 Part 4.

[147] 411.8 Parts 3 and 4.

[148] Ltr, Standard Brick and Tile Corp., Macon, Georgia, to Senator George, 19 Aug 42. Incl with Ltr, George to Reybold, 25 Aug 42. 411.8 Part 4.

[149] Ltr, Robins to Haynes, 19 Aug 42. Same File.

engineering standpoint. On 1 September both officers replied. Daley listed seven hospitals built of brick, one of cinder block, one of concrete block, and one of tile. At three of these jobs, a shortage of skilled masons had delayed the work. At one, the area engineer had had to switch to wood for quarters and warehouses in order to meet completion deadlines. Daley could furnish little data on costs. Only at the Woodrow Wilson General Hospital at Staunton, Virginia, had the Corps called for alternate bids. There, the price of brick with tile backup was 17 percent more than wood. At the Des Moines General Hospital, the area engineer estimated the cost of masonry at about 10 percent above wood, but Daley thought 15 percent was more like it. In his report for Groves, Stratton said he thought it entirely feasible to substitute masonry for wood on all one-story structures. It would be expensive, however, with the cost differential probably ranging as high as 30 percent. Stratton was against using masonry for two-story buildings. Prices, he felt, would be too far out of line.[150]

After mulling over these reports, Groves made up his mind. On 15 September, at his direction, Stratton issued new instructions to the field. District engineers would accept alternate bids for masonry under the following conditions: labor and materials were at hand, no delay would result, and the cost differential would not exceed 15 percent. Although this policy opened the way for greater use of brick and tile, it was a good deal less than masonry interests had hoped for. Continued agitation plus the persistent shortage of lumber caused the Engineers to hike the differential, eventually, to 25 percent. Unquestionably, the cost of using masonry was high. But, as Zackrison emphasized, it was materials not dollars that really counted.[151]

By assembling the world's largest chain of hotels, the Engineers saved not only materials but time and money as well. Miami had shown what could be done. Although commanders there were having some headaches (maintaining discipline in a vacation atmosphere was not the least of their troubles), the Army pushed ahead with plans to expand the program. During the summer and fall of 1942, O'Brien took possession of several hundred hotels—47 in Atlantic City, 48 in Daytona Beach, 58 in St. Petersburg, and 200 more in Miami. Negotiations were, for the most part, swift. Owners evicted guests, packed draperies, rolled up oriental rugs, crated objects of art, and turned over their hotels. Airmen moved into such swank hostelries as the Shelburne, the President, and the Marlborough-Blenheim in Atlantic City. The WAAC took over Daytona Beach. The Greenbrier at White Sulphur Springs and the Breakers at Palm Beach became general hospitals. By early 1943, 536 leases were on the books and 14 hotels belonged to the government.[152] O'Brien could well boast that the Corps of En-

[150] (1) Memo, Daley for Groves, 1 Sep 42. Opns Br Files, Gr Tps Sec. (2) Memo, Stratton for Groves, 1 Sep 42. Opns Br Files, Engrg Br.

[151] (1) Ltr, Stratton to Div Engrs, 15 Sep 42. 686 Part 2. (2) 411.8 Part 4. (3) USW Files, 411.1 Lumber. (4) OCE Circ Ltr 3541, 10 Feb 45. (5) Zackrison Interv, 27 Apr 65.

[152] (1) 601.53 (Miami Beach); (Atlantic City); (Daytona Beach); and (St. Petersburg). (2) Col Walter E. Lorence, Logistics in World War II: Engineer Phase (MS), Part III. EHD Files. (3) Memo, O'Brien for OUSW, 25 Oct 42. 601.1.

gineers had put the Statlers "in the shade."[153]

The largest of O'Brien's hotel transactions involved the Stevens in Chicago. The biggest hotel in the world, the 3,000-room, 22-story Stevens had been built in 1927 at a cost of $27 million. In June 1942, when General Arnold asked Groves and O'Brien to buy the huge hotel, they demurred, arguing that the price would be too high and eventual disposal would be too difficult. But when Arnold insisted he had to have the Stevens, they agreed to lease it. Negotiations soon bogged down. The owners' demands appeared excessive—an annual rental of around $1 million and $5 million more for rehabilitation and new advertising upon termination of the lease. Going to condemnation, O'Brien took possession on 1 August. Some 9,700 air trainees moved in a short time later. While the case was awaiting trial, word came that the owners would sell if the price was right. They finally accepted $5.6 million.[154] Whether, as Senator Byrd implied, the Army had bought a white elephant, or whether, as Patterson asserted, the purchase was "a sound one," only time would tell.[155]

For many GI's, hotels served as training centers and hospitals. At peak the capacity of these establishments was 160,000 men. Representing an investment of $14 to $15 million, properties purchased by the government included, besides the Stevens, the Biltmore at Miami Beach, the Don-Ce-Sar at St. Petersburg, the Forest Hills at Augusta, Georgia, and the Eastman at Hot Springs, Arkansas. The yearly rent bill on leased properties was $12.5 million. The annual cost per man was $170, including maintenance. Cantonments for 160,000 men would have cost upwards of $100 million. The cost of building Camp Polk had been $1,263 per man—or $253 per year over a five-year period. Substantial though the saving in dollars was, savings in time and materials were far more significant. Commending the Army for its resourcefulness, the House Military Affairs Committee pointed out that using hotels had saved from 4 to 6 months' time plus immeasurable quantities of materials.[156]

An avenue to greater savings had long been closed. In the spring of 1917, faced with short mobilization deadlines and tight construction budgets, the Cantonment Division had planned to halve the peacetime space allowance—60 square feet of floor and 720 cubic feet of air space per man—by installing double-decker bunks in barracks. Interposing immediate objections, Surgeon General of the Army William C. Gorgas had convened a board of eminent physicians, including Dr. Victor C. Vaughn of Michigan University and Dr. William H. Welch of Johns Hopkins. Emphasizing the dangers of overcrowding, the board warned that the space allowance was "altogether too small." Respiratory diseases would be "practically uncontrolla-

[153] Rpt by O'Brien, 1943, sub: Status of RE Program. RE Br Files, Misc Rpts.

[154] (1) Ltr, Ernest J. Stevens to Stimson, 21 Dec 42, and related docs. 601.1 (Stevens Hotel) I. (2) Ltr, AAF to CofEngrs, 5 Jun 42. 601.53 III. (3) Memo, AAF for Somervell, 19 Jun 42. RE Br Files, Memos for Gen Arnold. (4) 601.53 (Chicago, Ill.) (Misc.) I.

[155] (1) Ltr, Byrd to Stimson, 15 Dec 42. 601.1 (Stevens Hotel) I. (2) Ltr, Patterson to Byrd, 16 Dec 42. 601.1 (Stevens Hotel) I.

[156] (1) Lorence, Logistics in World War II, Part III. (2) Memo, O'Brien for Amberg, 2 Nov 44. 601.1 Part 11. (3) *Business Week*, October 9, 1943, p. 28. (4) Washington *Times-Herald*, July 29, 1943, p. A2.

AIRMEN EXERCISING ON GROUNDS OF STEVENS HOTEL

TABLE 19—VARIATIONS IN BARRACKS CAPACITY

Type of Barracks			Capacity		
Series	Heat	Lavatories	Normal	50–450	40–375
TO	Stoves	No	32	40	50
700	Stoves	No	45	63	74
700	Furnace	Yes	63	76	91
800	Furnace	Yes	74	85	105

Source: Memo, Robins for Somervell, 4 Jul 42. 621 Part 1.

ble" if men were housed "too close together." Prison inmates and flop-house denizens had more space than Littell planned to give the boys in uniform. In conclusion, the board stated, "We believe that no sanitary advice is sound which does not provide for at least 500 cubic feet of air space per man."[157] Secretary Baker approved the report of the medical men and directed Littell to use it as a guide. After the war, Army Regulations prohibited overcrowding, forbade double bunking, and prescribed an allowance of 60–720 per man, except in emergencies, when the minimum would be 50–500.[158]

From the start of the rearmament program, construction officers had advocated double bunking and reductions in space allowances—steps strongly opposed by Surgeon General Magee. In the summer of 1940, when Hartman suggested temporary double decking, Magee entered an "emphatic protest against any such practice." He warned: "From the standpoint of health such crowding of men, particularly recruits, is dangerous."[159] This warning blocked the move. A year later, when Somervell tried to invoke the emergency clause in the Army Regulations, Magee counseled against it. "Double-bunking," he averred, "should never be resorted to and is prohibited by regulation."[160] Until the fall of 1942, the Surgeon's view prevailed.

In the spring and summer of 1942, as materials shortages became increasingly desperate, the Engineers pressed hard for reductions in space allowances. At a high-level conference in May, Groves introduced the subject:

> We can decrease our efforts . . . by the double bunking of our men in barracks. I realize that this is very objectionable from the standpoint of the Medical Department perhaps, though it would be less costly in life to the United States if we double-bunked the men in barracks and diverted that effort to a more useful field. I personally lived in a double-bunk room quite a while, and I did not find it objectionable. What the medical conditions will be here I am not prepared to discuss.[161]

[157] Medical Board Rpt, 14 Jun 17. SGO 621–1 (Bks for EM).

[158] (1) Memo, Actg CofS for TQMG, 14 Jun 17. AG 2595123. (2) AR 40–205 15 Dec 24, par. 19.

[159] Ltr, SGO to TAG, 6 Aug 40. SGO 427.4.

[160] 1st Ind, SGO to TQMG, 22 Sep 41, on Ltr, AAF to SGO, TQMG, and CofEngrs, 10 Sep 41. QM 621 (63–Man Bks).

[161] Min, Engr Production Conf, 22 May 42. 337 (Engrs, Corps of).

DOUBLE-DECKER BUNKS IN PERMANENT BARRACKS, *March Field, California.*

Six weeks later General Robins asked Somervell to cut allowances to 50 square feet of floor and 450 cubic feet of air space, and, as a temporary measure, to sanction further reductions to 40–375. Robins furnished data showing how much the capacity of various barracks would increase.[162] (*Table 19*) Somervell referred Robins' letter to The Surgeon General, who promptly protested: "The housing requirements as laid down . . . have been carefully arrived at by scientific observation and experience. These requirements are essential if high rates for infectious diseases are to be prevented." General Magee "urgently recommended that no change be made . . . except where this expedient must be taken by a field commander to meet a temporary situation."[163]

The Engineers persisted. After discussions with Somervell, Groves investigated the possibility of double bunking barracks at staging areas. On 22 August he reported that the overall

[162] Memo, Robins for Somervell, 4 Jul 42. 621 Part 1.

[163] 1st Ind, 11 Jul 42, on Memo, SOS for TSG, 8 Jul 42. SGO 621–1 (Double Bunking).

capacity of camps serving the New York, Boston, and Hampton Roads ports of embarkation could be augmented from 117,486 to either 143,753 or 233,172, depending on which formula was applied. To avoid additional construction, he recommended the 50–450 formula rather than the 40–375. But Somervell wanted to go all the way. Rejecting Groves' proposal, he asked the Chief of Engineers to study the matter personally.[164] "This was rather typical of Somervell," Groves asserted. "Whenever he found that he and I were not in agreement on a matter such as this, he would ask Reybold to study it personally, fully aware that Reybold would always go along with him."[165] On 8 September Reybold expressed his agreement with Somervell's view. Ten days later Somervell cut the space allowance at staging areas to 40–375.[166]

Meanwhile, the Engineers pushed on toward their goal of double bunking the entire military establishment. In a memorandum to Somervell, which he prepared for Reybold's signature in mid-September, Groves urged an across-the-board reduction to 50 square feet per man. At major ground troop stations alone, he claimed, the change would make room for nearly 400,000 additional men. Messing, recreational, and administrative facilities would pose no problems; hospitals could add wings or expand into converted quarters; and even water and sewer lines could probably carry the load. Once again, Somervell went further than Groves had recommended. On 21 October, with General Marshall's approval, he slashed space allowances to 40 square feet at all Army installations, except replacement training centers, reception centers, and schools, where 50 square feet would be the minimum. He suspended the conflicting paragraph of the Army Regulations and on 31 December 1942 published a new regulation, incorporating the change. At a stroke, Somervell had increased housing capacity nearly 50 percent.[167] As General Magee had feared, the respiratory disease rate rose sharply, reaching a peak in January 1943, and thereafter "diminishing slowly but progressively." According to Magee, the reduction in space allowances, though not the only factor, was "one of the most important elements in the whole situation."[168]

At a conference held at the New War Department Building on 28 September 1942, General Robins and his staff heard Colonel Hardin summarize their efforts to save materials. Before a large and distinguished audience (among those present were Patterson, Knudsen, Eberstadt, Clay, and Harrison), Hardin spoke of simplifying designs, finding substitutes for scarce commodities, pooling supplies and equipment, procuring materials necessary to carry on the

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[164] (1) Memo, Groves for Somervell, 22 Aug 42. 600.1 Part 14. (2) Memo, Somervell for Reybold, 26 Aug 42. 600.1 Part 14.

[165] Groves Second Draft Comments, XVII, 1.

[166] (1) Memo, Reybold for Somervell, 8 Sep 42. 600.1 Part 14. (2) Memo, SOS for CofEngrs, SGO, . . . 18 Sep 42. 600.1 Part 14.

[167] (1) Memo, Reybold for Somervell, 21 Sep 42. 600.1 Part 14. (2) Groves Comments, XIII, 3. (3) WD Ltr AG 600.12 (9-21-42) OB-S-SPRMC-M, 21 Oct 42, sub: Reduced Space Allowances at Posts, Camps, and/or Air Force Stations. (4) AR 40-205, 31 Dec 42, par. 10.

[168] 1st Memo Ind, 22 Mar 43 on Memo, ASF to SGO, 14 Feb 43. AG 600.12.

work, taking over civilian properties, and making more intensive use of the military plant.[169] As they listened to the presentation, the veterans of the materials battle could feel reasonably certain they had done all they could. There was little else anyone could do, short of cutting the size of the program.

[169] Min, Engr Production Conf, 28 Sep 42. 337 (Engrs, Corps of).